POPULAR SCIENCE

FOUNDED MONTHLY 1872
SM

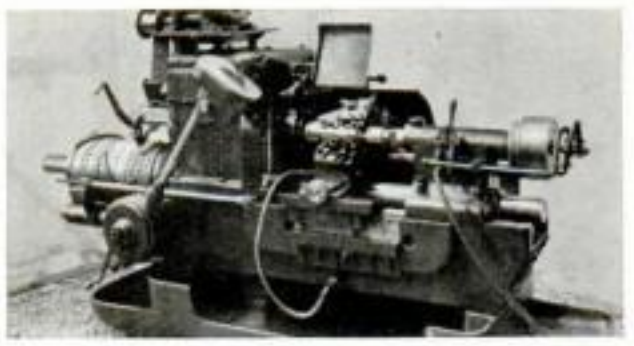
AUGUST
25 CENTS
30 CENTS IN CANADA

WINGED TARGET
FOR FLYING GUNNERS
Page 53

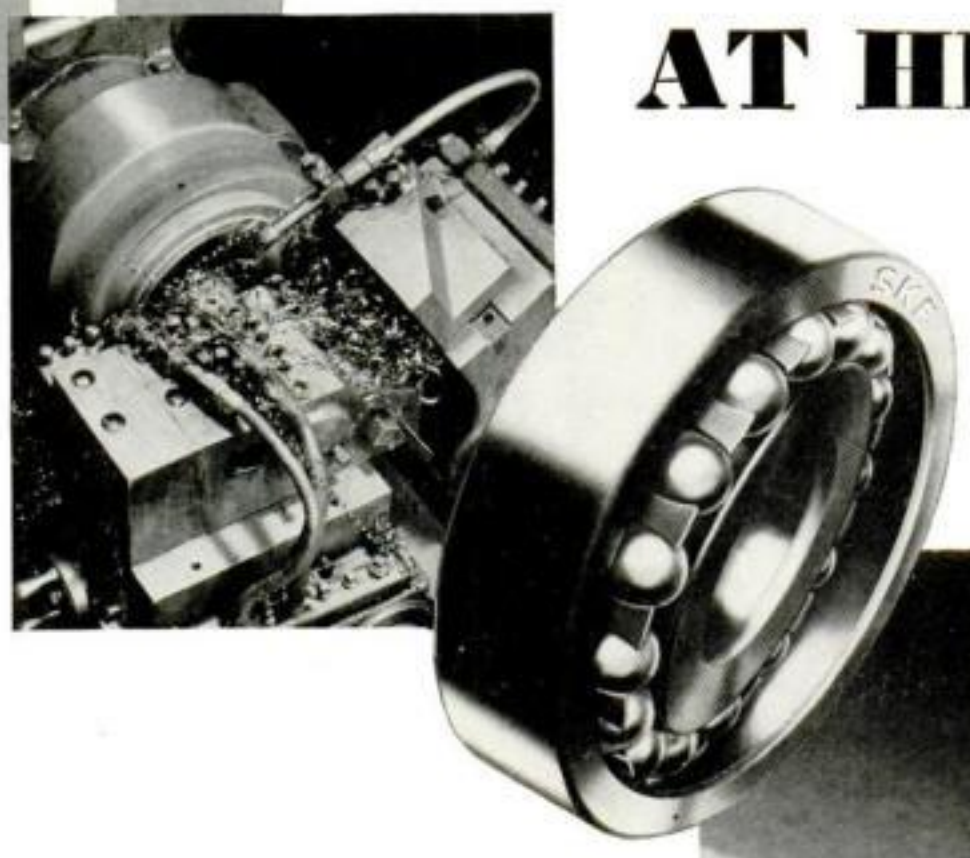
$10,000 *in* Cash Prizes

SEE PAGE

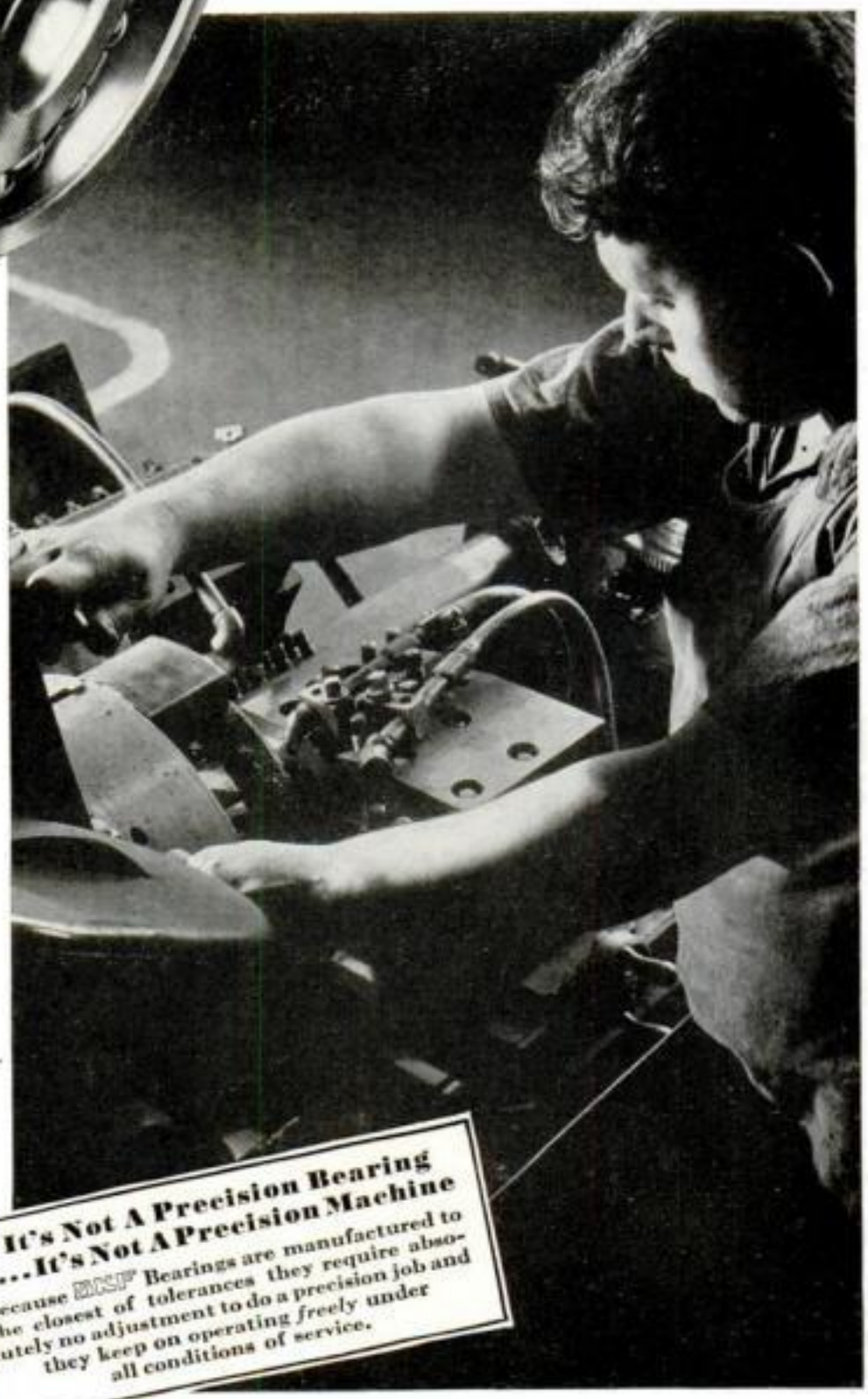
Fay Lathe equipped with SKF Bearings. Eight years of operation in a busy Detroit automobile plant failed to show any appreciable signs of wear in the bearings.



8 YEARS AT HIGH SPEED



... AND NO APPRECIABLE SIGNS OF WEAR!



Performance... not purchase price... is the real measure of value in bearings. Performance such as SKF delivers day in and day out in thousands of varied industries. Performance that is the product of sound, time-tried design... of specially selected materials... of manufacture up to standards of precision that border upon perfection. And where bearings are concerned, performance always talks louder than a price tag.

In the Fay Lathe shown here, the performance of the bearings was typical of SKF. For eight years this lathe was operated at high speed in a Detroit automobile plant. For a large part of this time it was in service for twenty-four hours a day. Yet when the lathe was dismantled for overhauling, the SKF Bearings showed no appreciable signs of wear. And at no time during their period of service did they require adjustment of any kind.

In practically every field of industry SKF Bearings have established records for long, uninterrupted, trouble-free service that no other bearing has ever approached. After all, performance in a bearing is the thing you pay for... performance is the thing you should demand.

SKF INDUSTRIES, Inc., 40 E. 34th St., New York, N.Y.

SKF
BALL & ROLLER BEARINGS

If It's Not A Precision Bearing ...It's Not A Precision Machine

Because SKF Bearings are manufactured to the closest of tolerances they require absolutely no adjustment to do a precision job and they keep on operating *freely* under all conditions of service.

2888

A PROMISE IS ONLY A PROMISE... *PERFORMANCE* IS HISTORY

The Age of Selection
is here

Our times are marked by one vast advantage over the past—freedom of choice for the average person.

A young man now has a hundred interesting careers to consider. His grandfather had ten. Many paths are open to the scientist, writer, teacher, athlete, business man. When we travel, we often choose between rail and bus and car and plane. Every last thing we buy is one of many offered.

This is the Age of Selection. For advertising keeps us informed. Tells us the special benefits of this, the new features of that. Shows us how to build houses and how to make muffins. Explains why and where and when and how much.

As we read we learn how to discriminate, to recognize worth, to be sure of value received. Before we buy a car or refrigerator or a can of beans, we know what it is and what it offers. Advertising teaches us how to live by this year's rules.

Read the advertisements in this magazine. They bring you up to date in this Age of Selection.

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ARTHUR WAKELING, *Home Workshop Editor*
ALFRED P. LANE, *Technical Editor*
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SYDNEY OXBERRY, *Art Editor*

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August, 1932. Vol. 121, No. 2. **Popular Science Monthly** is published monthly at 381 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Single copy, 25 cents (30 cents in Canada). Nine months subscription in U. S., $2. Yearly subscriptions to United States and its possessions, $2.50; foreign countries, including Canada, $3.

Popular Science Monthly for August, 1932

NEW DEVICES FOR THE HOME

NEW PROCESSES AND INVENTIONS

PHOTOGRAPHY

UNUSUAL FACTS AND IDEAS

FOR THE HOME OWNER

CRAFTWORK

WOODWORKING

IDEAS FOR THE HANDY MAN

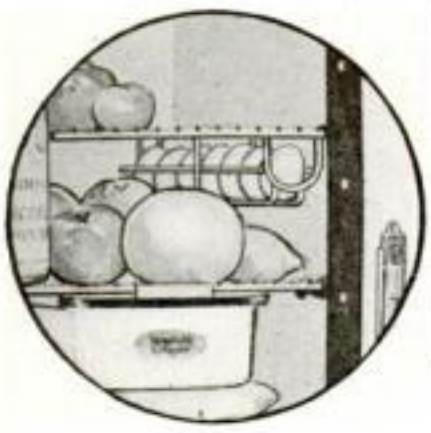
HINTS FOR THE MECHANIC

In This Issue—Hundreds of Articles and Pictures Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions

Dependable Refrigeration

. . . A PRODUCT OF ENGINEERING SKILL

Sliding shelves make it easy to reach everything in refrigerator



An egg rack that does away with cardboard box fastens to underside of shelf in up-to-date refrigerator

Several new refrigerators contain a water cooling unit with handy faucet

Opening the refrigerator door is easy with this handy pedal, the operation of which is illustrated at right

Some ice cube trays are of flexible rubber, and bending them frees contents

This refrigerator has a built-in water cooler, automatic light, and bottle opener

By R. M. Bolen

Secretary, Popular Science Institute

IN SELECTING a mechanical refrigerator, the prospective buyer should look first for dependability and soundness of mechanical design. More important than size, shape, and price is the fundamental engineering skill with which the refrigerating unit and cabinet have been designed and the supervision under which they are manufactured so as to insure the utmost in efficiency, service, and economy. Unless a refrigerator is constructed along sound engineering principles, nothing else in its make-up can give it the perfect food-preserving qualities that have, through the efforts of conscientious pioneer manufacturers in the field, become synonymous with the phrase "mechanical refrigeration."

Mechanical refrigerators now feature ingenious conveniences designed to aid the housewife, but the buyer first should make sure that these are combined with a carefully constructed refrigerating unit and a heat-proof cabinet.

One manufacturer of a high-grade household refrigerator, besides other conveniences, has incorporated sliding shelves into the design of the cabinet. Being coupled with a dependable unit, these shelves aid in the preserving of foods since they make it easy to arrange dishes and other containers in such a way as to take full advantage of the entire shelf area without, however, impeding the flow of chilled air from the refrigerating coils.

Cardboard egg boxes, bulky and insanitary at best, are no longer necessary in one refrigerator which has a wire egg rack conveniently placed under the shelves.

With several makes of mechanical refrigerators, ice water no longer requires ice. A touch of an easily cleaned nickel plated spigot gives a stream of cold, crystal-clear water. In one refrigerator, these cooling units are built in, the only outward sign of their presence being a movable faucet which can be easily turned back out of the way when not in use.

The provoking hunt for a bottle opener is ended in the home equipped with a refrigerator having a sturdy opener cleverly incorporated into the door latch.

To eliminate groping and hunting in refrigerators unavoidably placed in dark corners, several manufacturers have applied the automatic closet light to their product. When the door is opened, a light flashes on, illuminating every shelf.

Now a housewife, with both hands laden with dishes, does not need a third hand to unlatch the refrigerator door. A foot-operated door-opening lever at the base of one 1932 refrigerator does the trick.

Rubber trays that allow easy access to tightly frozen ice cubes are another feature on many refrigerators that prove a genuine convenience. No thawing of ice in metal trays with the resulting diminished size of the cubes. A simple twist of the flexible tray and the cubes fall free.

Vegetable drawers or racks are another feature that is more or less standard equipment on many refrigerators.

INSTITUTE BULLETINS

Heating and Ventilating*
Insulation in Building Construction*
Advice on Installing Oil Heat
List of Approved Tools
List of Approved Radio Sets
Approved Oil Burners

** Starred bulletins 25 cents*

FOR THE HOME OWNER

Two Booklets Contain Much of the Information You Need in Building or Modernizing a House

House Heating and Ventilating will help you to get the most from each building dollar invested in heating equipment, by advising how to plan wisely and by supplying full facts regarding equipment now available.

In this 38-page booklet will be found descriptions of the various types of heating systems, an outline of the advantages and disadvantages of each under different conditions, together with pointers as to how to select the kind most suitable for your needs. Also, instructions are given on how to get the best results with each system through proper care.

There are special chapters on heating with coal, oil and gas which contain comparative data on cost and advantages, as well as the essential facts that need to be known if you are considering the installation of an electric stoker, oil burner or gas heating system.

Automatic heat control, room heaters, humidity, ventilation and summer cooling are other subjects treated in this booklet and, throughout, are illustrations showing various types of modern equipment.

Insulation in Building Construction covers a subject that many buyers and builders of homes need to know about. Many houses are represented as being "insulated" when they are not really insulated at all.

This booklet explains in dollars and cents just what insulation does in saving heating costs, as well as providing comfort at all seasons. From the facts given, you can decide whether insulation is a worthwhile investment for you.

Detailed description is given of the various insulating materials, their comparative rating as regards efficiency in stopping heat flow, and other factors that need to be considered in selecting insulation.

One section of the booklet describes how to insulate houses that are already built and a final chapter deals with the cutting of heat loss through use of weather-stripping, calking compound, etc.

These booklets have been prepared by the engineers of Popular Science Institute. They may be had by sending 25 cents for each to Popular Science Institute, 381 Fourth Avenue, New York, N. Y.

Our Readers Say

Origin of Living Matter Remains Deep Secret

I SHOULD like to ask a question or two suggested by your biological series: Why, if there were causes that resulted in a tiny speck of living jelly, did those causes cease to function after that one speck was created? Why could not those causes produce a second speck of life? Will you give a fact or two to prove that man evolved from some lower form of animal life? If evolution was once operative what would stop it? Surely during the 4,000 years of written history there should be some manifestation of the evolutionary tendency. Is there any evidence to show that one species crosses with another to produce a third and different species? Personally it is easier for me to believe that man was created by an all wise God and endowed with a soul than to accept the theory that life pushed itself up from nothing to man's present state.—C.B.B., Ft. Lupton, Colo.

So Then It Appears Relativity Is Bunk

IN CITING Sir Oliver Lodge as authority for the claim that matter has no effect on the ether, R. G. merely substantiates the well established fact that the attributive "logical" is not a derivative of the substantive "Lodge." It was the illogical claims of Sir Oliver and his compeers that afforded Einstein opportunity to foist upon a misguided public his doctrine of relativity. Sir Oliver's assumption that the ether is an "incompressible and fundamental medium, filling all space," is in flagrant conflict with the law of probabilities. The chance that it is correct is to the chances that it is not, as one is to infinity. And the hope of successfully impugning the Newtonian hypothesis hinges on that slender probability. As Professor Einstein is inclined to the opinion that the universe is exploding, R.G. should get wise to the fact that so far as the theory of relativity is involved in that cosmic catastrophe, it is all over but the shouting.—E.H.P., Wellington, Ohio.

There Ought to Be a Law, Or Is There—Unenforced?

THANKS for your article on radium. There are other brands of bogus and dangerous dope you could expose but there's no reason why you should do all of the dirty work, is there? What about a law controlling these nostrums? There ought to be one and probably is, but no one takes the trouble to enforce it. Meanwhile, pain is coined into greedy dollars and thumbs caress noses turned toward the gullible and long suffering public and the gesture goes unchallenged. Hasn't the dear public got a foot? If so why doesn't it give these vicious vendors a kick in the pants? I for one am eager to try out a heavy boot.—F.A.W., Miami, Fla.

But Wouldn't the Tapeline Stretch, or Something?

HAVING read the problem pertaining to the earth and a tapeline in "Our Readers Say," I submit this solution: Being given the circumference of the earth and the circumference of the circle made by the tapeline after ten have been added, the diameter of the earth and of the circle made by the tape can be found by substituting, in the formula, diameter equals circumference divided by pi. When the diameters are found take their difference and divide it by two. This will give 1.67399 feet, the distance between the earth and the tape.—E.E.S., Pensacola, Fla.

We Never Said You Had to Fall in the Creek

I HAVE been a POPULAR SCIENCE MONTHLY reader for a long time but I have never bothered you until now. I should not bother you now but you had an article in a recent issue on how to take pictures underwater that did not work out right when I tried it. I made the box with the glass window in it, placed the camera in the box, put the box in the water, but when I went to take the picture I fell in the creek. Now as the water is awful wet, isn't there some other way I can get pictures of this kind and keep dry?—R.E.W., Drayton Plains, Mich.

He Applauds the Spirit but Questions the Grammar

ON PAGE 10 of the June number the letter of R. R. Y. requesting that articles be more technical applies to that of G. B. F. in the next column, who asks you to make the magazine "three times bigger." I think he means "three times as large." A magazine three times bigger would be four times as large. I am inclined to question the statement of M.G.V. on page 11 as to "scientists who have very broadmindedly taken God out of our universe." To me it is not difficult to believe that God created the earth and things on it, in the ways described by the scientists. The only difficulty then is to determine the length of time covered by the "six days" of the Bible.—A.L.F., West Roxbury, Mass.

International Finance Would Prove a Big Subject

MOST of your articles are very interesting, though some, you must admit, are pure bunk, but of course you cannot satisfy all your readers at once. If you will not consider it too much presumption on my part, I would suggest the publication of articles on international economy and finance at the present time. This would be a subject of great interest to the majority of the public in these days especially. Also articles dealing with higher education in the United States of America, which should be of much interest to most of my co-readers, for is not education the mother of science and invention?—C.E.G., S. Fernando, Argentina.

But Why Not Tell Us the Fifth Boy's Interest?

THERE are five boys in our family and we all read POPULAR SCIENCE MONTHLY from cover to cover each month. One of the boys studies aviation, another is an auto dealer, one likes radio, and I am an insurance man, but you give us all something of interest in each issue and there is a scramble to get the book.—N.C.R., Fort Worth, Texas.

Free-Playing Imagination Found the Mine Gas

I AM writing about an article in a recent issue that is so manifestly not in accordance with facts that I am sure you will desire to correct it. I refer to the article entitled "Households on Wheels Flee Gas from Mine." I do not know who your informant was, but certainly no such situation ever occurred as depicted here. I have read your magazine for a number of years and it has a most excellent record, and I am sure that you will regret that you have been the victim of such an incorrect story. The facts are that the Cumberland mines were opened in 1900 by The Union Pacific Coal Company, and the mines continued in operation until June 21, 1930, when they were closed down on account of the exhaustion of the coal resources. The entire town was dismantled and the equipment moved away. Employment was found for all those from Cumberland in the other mines of The Union Pacific Coal Company at Rock Springs. The houses are being moved by the firm who purchased them, and are being sold through different parts of the country. Certainly no one ever died from gases, as your article states. Nor were the mines abandoned for this reason, but because there was no more workable coal. —G.B.P., Rock Springs, Wyo.

You May Be Right, but We Need More Light

DOES light travel? The majority of your readers will say yes. Before you make that answer, however, I should like your reply to the following: Star A is one light year distant from the earth. A large planet, B, is nearly as far and passes across the face of A. What happens? Assuming planet B does not give off light, do we observe at the exact time of transit or a year later the obliteration of A? Is is my belief that light is

instantaneous and space a vacuum. The exaggerated size of the sun at rising and setting and the absence of stars near the horizon serves to prove space is a vacuum. Light is not transmitted but is instantly visible because there is no obstruction to hinder it. —J.V.L., Evansville, Ind.

Sounds All Right, but It Must Be Cockeyed

HERE is a problem I should like to submit to your readers: If I am asked the question, "Is it true that ice will melt at a temperature of zero, Centigrade?" I must answer, "Yes." If I am then asked, "Is it true that water will freeze at zero, Centigrade?" I must again answer, "Yes." If both answers are right have we not, then, an example of perpetual motion as the water will alternately continue to freeze and melt forever? Of course this is impossible, but it would lead one to think that perhaps the melting-freezing points of water are not quite the same, the one being below and the other above zero, Centigrade. Can I get further light on this from any of your readers?—W.M.G., Port Washington, N. Y.

His Watch Runs Backward and Keeps Good Time

IN A recent issue of POPULAR SCIENCE MONTHLY, I noticed an article about a watchmaker who had succeeded in designing a watch that runs backward. You stated that this, probably, was the only one of the kind in the world. When I saw that, I, who am also a watchmaker, decided to do the same trick. I set to work on a twelve size watch and within three or four hours succeeded in making it run backward. No parts were added and none were removed. It appears to be the same as any other watch but the hands move backward and the stem winds backward. It runs perfectly and keeps accurate time in reverse order. To build this watch seemed to me no problem at all. I have the testimony of a scientist connected with our local high school to the effect that the watch does exactly what I claim for it. —W. L., Spartanburg, S. C.

Maybe the Mayans Just Got Tired and Quit

THERE are, I think, three serious flaws in Doctor Cooke's theory regarding the fall of the Mayan Empire. First: There are no pictures or remains of boats found to show Mayans built and used boats. Second: The beginning of the First Empire dates from A.D. 68 in the city of Uaxactun. From there the people spread southward into the extreme southern part of Guatemala, erecting cities as they progressed southward. But in A.D. 530, a general exodus started from these southern cities. If the lakes were being filled by the erosion of the soil, then it is logical to believe that the exodus would have started from the northern cities, the last to be abandoned but the first to be erected. Third: It is known that seven or eight centuries after the Old Empire was abandoned, a part of the descendants of the original dwellers returned to this area. If we say that the lakes were not navigable when the cities were abandoned, it is evident that they would not be so later.—C.McD., Morehead, Ky.

Glider Fans Still Active and Asking for Dope

I REMEMBER that some months ago you ran articles about gliding. Hawley Bowlus, noted glider pilot, was the contributor of some of these. How about more of such articles. Why not encourage this sport? I am a glider fan. In fact, I am the owner of the glider you pictured up in telephone wires, with Sid Carlson as pilot. There was a national contest at Elmira last September. I was lucky enough to be there. You could find plenty of material for a gliding article by reporting that meet.—B.S., Sea Cliff, N. Y.

Even "Selfish Mortals" Are Entitled to a Break

I WISH to commend the manner in which you conduct POPULAR SCIENCE MONTHLY. It is a great magazine. Please pay no attention to the critics who write "Our Readers Say" and want this or that all of the time. They are merely selfish mortals who think that because they like a certain thing everyone must like and want the same thing.—J.L.S., Jr., Feeding Hills, Mass.

Articles on Microscope Are Now on Their Way

THE members of the Astronomical Section of the Academy of Science and Art of this city wish to add their voice to the request that your magazine publish articles, elementary in character, dealing with the use of the microscope and how to enjoy it as a hobby. Many of the members of this section, unable to use their telescopes on unfavorable nights, turn naturally to the microscope, but articles dealing with first steps in the enjoyment of this particular interest are hard to secure, and if your magazine should foster this hobby, that would be something. We trust you will consider this request.—L.J.S., Pittsburgh, Pa.

Something for the 600,000 Motorbike Fans on Page 26

I AGREE with R.A. of Nashville, Tenn., and with D.N.C. of Norfolk, Va. You overlook the people who cannot afford a plane. Why not give us a page on motorcycles now and then? There are about 600,000 motorcycles in the United States, against a much smaller number of private airplanes. You already have a superlative magazine.—W.M.B., South Haven, Mich.

Gregory's Fairy Tales Come From House of Marvels

WHEN I read J.P.R.'s letter in a recent issue I decided to indict the whole of POPULAR SCIENCE MONTHLY staff for seeking, aiding, and abetting story telling. I also herewith indict my good friend Dr. Gregory, who notwithstanding his infinite patience and a lifelong and painstaking labor in the study of vertebrates and kindred subjects, told me, as well as showed me skeletons, on his own desk, in his own home, proof of the fairy tales J.P.R. refers to. May I respectfully ask J.P.R. to reconsider his opinion and pay a visit to the American Museum of Natural History in New York City, and feel at first hand that atmosphere Alice felt when in Fairyland, for truly, J.P.R., the many labyrinths of the Museum are a veritable Wonderland of *fairy tales* from life.

As for astrology, your artist got ahead of me by drawing the very good little picture accompanying J.P.R.'s letter. The *crooked* telescope with the bird at the large aperture, and all the other appurtenances, say all there is to be said on the subject.—P.B., New York.

"Hold Your Breath for We Are Coming"

I HAVE spent many hours searching through magazines for a good set of plans and directions for making a miniature stage. I read with interest your articles for making various objects. Then I decided to write to you and ask for explicit and exhaustive plans for a miniature stage. May I implore, suggest, and hope that you will, in some issue in the near future, include the plans I long for? I shall hold my breath until I see those plans.—(Miss) L.A., Burbank, Calif.

Here's One More Crack at the Autogiro Mystery

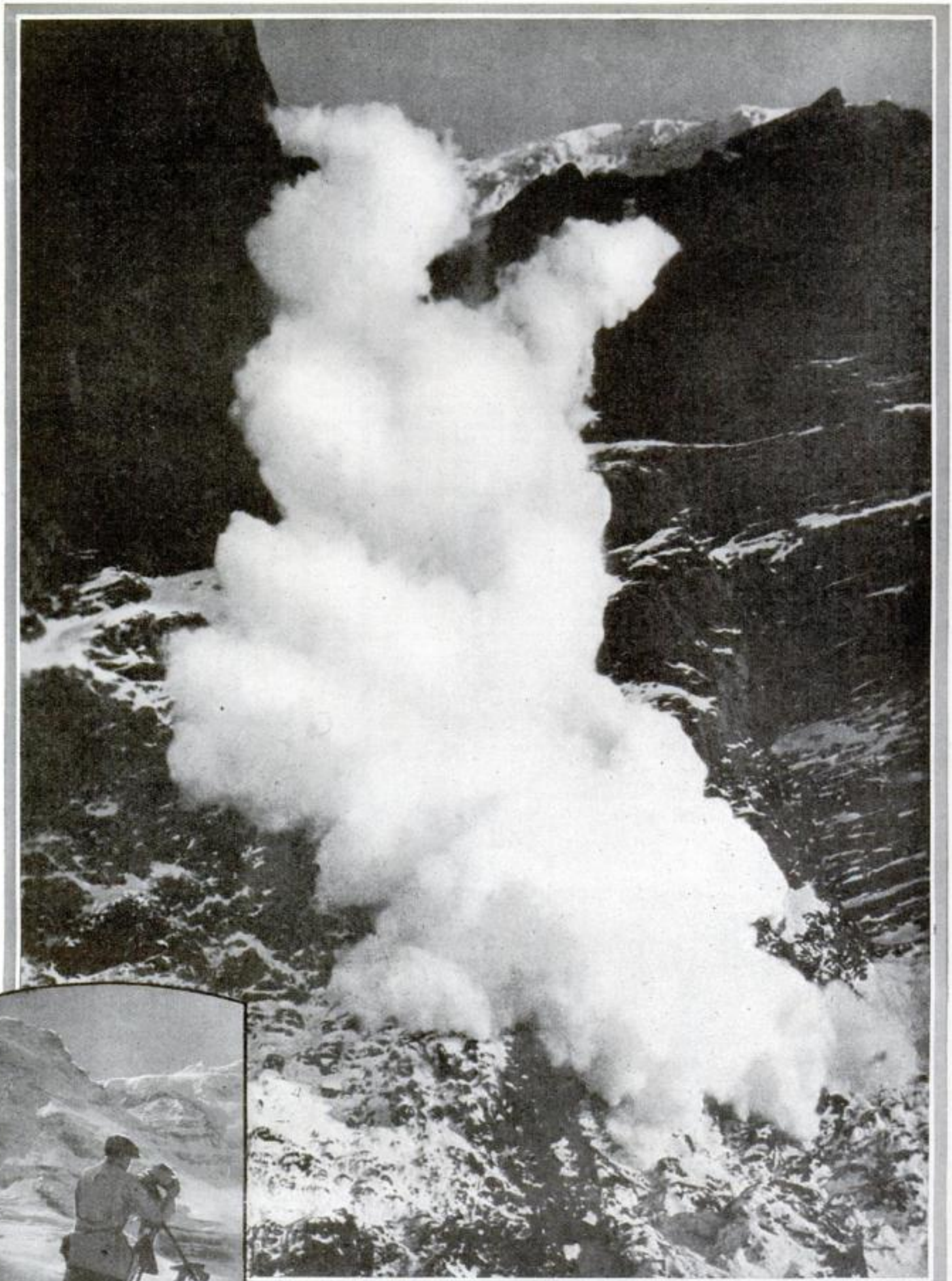
THE answer of R.D.H., Ashley, Ind., to V.V.S., Maleny, Australia, does not satisfy me. From observation, but asking no questions, I have satisfied myself that when power is applied to the giro vanes, a mechanism at the hub causes them to spiral or lift up. When declutched or released, the pitch or spiral reverses. The result is it rotates in the same direction, always lifting whether they are driven by the engine or air driven by the propeller.—C.E.B., Huron, S. D.

They Laughed at Watt and Made Fun of Fulton

WHEN louder and better laughs are furnished, you'll be on the job. That diamond story was about as fine a piece of humor as I've read in a long time. All you need now is a perpetual motion machine and you're all set. You hint that industrial diamonds can be turned out at little or no cost. Following this you give an elaborate, hazardous, and expensive method that produces a tiny diamond of no value to jeweler or manufacturer. The article is interesting—the deduction, hysterical. That's where I get my laugh. Nature is as Nature does and your funny laboratory is not yet equipped to work on a colossal scale, to harness cosmic forces to squeeze tear drops from carbon.—J.W.L., Bronxville, N. Y.

Now Ditch Diggers Find an Alibi in the Moon

THERE seems to be so much interest centered around this matter of moon effect upon agriculture that I think I'll spring a funny one I heard recently. This is none other than a man who argued with a bunch of us fellows at the employment agency that he knows from "actual experience" that the amount of dirt you get out of a hole dug in the ground of any given dimensions with full moon overhead is lots more than you get from a similar hole in the same ground with the moon not at full. He had the whole office full of people laughing and kidding him but he earnestly stuck to his silly story. Now what reader can make or break this tale? Be it understood, however, that this man could offer no reason *why* this should be the case.—A.V., New York, N. Y.



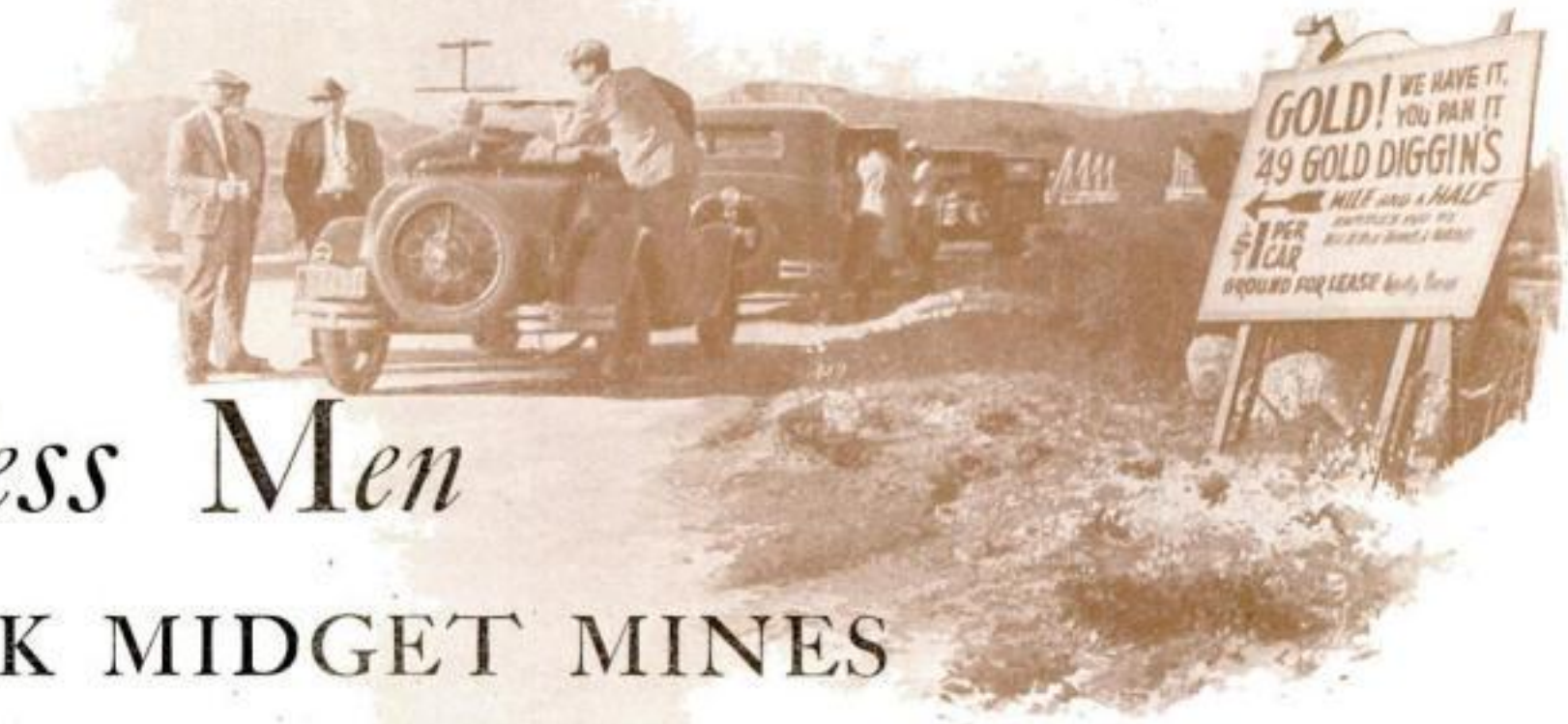
Can Devastating Avalanches Be Tamed?

This Remarkable Picture Was Taken as 5,000 Tons of Snow Rushed Down the Famous Matterhorn in the Alps. At Left, a Member of a German Scientific Expedition Is Taking a Picture of a Snowslide in a Study That Seeks a Way to Curb Their Terror *(See Page 24)*

POPULAR SCIENCE
MONTHLY

August 1932 Vol. 121, No. 2

RAYMOND J. BROWN, *Editor*



Jobless Men WORK MIDGET MINES *in* New Gold Rush

The jobless man, turned miner, is a tenderfoot at the business and he usually picks his gold from the sluice as fast as it appears, using a pair of tweezers. This method is laughed at by the veteran

By Sterling Gleason

NOT since '49 has the West seen so great a gold rush as the one that is now on. Old hills, honeycombed with tunnels dug by prospectors half a century ago, are coming to life. Stream beds in the placer districts are swarming with gold seekers. Scores of miniature mines, operated single-handed with crude, home-made equipment, are springing up as an army of small-scale miners seek a livelihood refused by the city.

Few of these jobless men are miners by profession. They come from all walks of life—barbers, bookkeepers, engineers, contractors, mechanics, carpenters, actors—out of a job, grateful for a chance to make a living, and willing to work hard for it. They are not looking for a big strike, but merely for enough to buy beans and bacon and tide them over until they can go back to their regular jobs. Some of them are making only a few cents a day, others are earning fair wages. A few have struck it rich and may yet make comfortable fortunes.

Recently I visited some of the centers of this activity where in the dramatic days of the last gold rush prospectors skimmed the cream of the mineral wealth, but did not bother with the lean deposits that panned a few cents to the ton. Now, miners' tents again line the streams. The banks are pitted with diggings in which scores of men are industriously shoveling dirt, screening it, and feeding it into sluice boxes. Every few feet in the river bed, a miniature rock dam diverts a portion of the water into these rectangular wooden troughs through which the water swirls, washing away dirt and sand and leaving the heavier gold behind.

High up on canyon walls, miners are digging tunnels or exploring pockets in the red earth. From their aerial perch they shovel the dirt down chutes made of joined sections of rainspout pipe, through which it rattles down into the sluice boxes. Others wheel the dirt from their diggings in wheelbarrows or send it in buckets over cables. Many of the novices carry it by hand in small pails, and feed it, little by little, into the sluice, hovering over the box until the dirt is washed away. Then they pick out the grains of gold, one at a time, with a pair of tweezers.

One old-timer told me, "This dirt is very lean, so lean that in

This dry washing machine, driven by an old truck motor, keeps several men busy shoveling dirt into it. The owner says it will handle 40 cubic yards each day

Below is a typical midget mine with a crude windlass that is used to haul dirt to surface

At right is a homemade dry washer. The dirt is shoveled into the hopper, then passing across the slanting chute, the bottom of which is ribbed to hold the gold that falls down

order to make anything, you've got to shovel like thunder all day long, just as hard as you can. This stuff averages only a few cents per cubic yard. Multiply that by the number of yards you can shovel in a day, and you have your daily wage."

Some simplify their work by ingenious mechanical devices. One man has rigged up an old motorcycle engine to pump water from the stream up to his diggings. Another aids the naked eye in detecting bits of gold in the sluice box by holding a section of a milk bottle, curved side up, just at the surface of the water. The glass acts as a lens that magnifies the grains of gold and at the same time does away with troublesome shadows and reflections in the water.

One of the most apt of these amateur miners is a man whose sluice box first drew my attention by the glint of some mercury which he had placed in the riffles.

"Me a miner?" he laughed. "Heavens, no! I'm a theatrical man. For twenty-eight years I was a stage carpenter, until the depression hit me and I took up mining. In the library, I read books on the subject and learned all I could. Then I pestered two old miners until they gave me a lot of practical hints.

"I built two portable sluice boxes about six feet long. Most of these people around here line their boxes with rubber running-board mats, with the ridges turned crossways of the stream; but these tiny riffles are too small to be efficient. I lined my box with burlap, then tacked chicken wire and cleats across the bottom. The fine gold sifts down into the burlap and the cleats catch the bigger chunks. A still better stunt is to use a strip of old carpet, nap side up. Then you can burn the carpet when you are finished, pan the ashes, and recover the gold.

"Later I hit upon the idea of using mercury to amalgamate the gold, as is done in large-scale mining. At a chemical supply house I paid $1.50 for a pound of mining mercury—not the dental mercury, which is more refined and costs three times as much but is no better for the purpose. Half a pound is enough to use in a small riffle box at one time. At the end of the day, I clean up. I put the concentrates from the sluice box, including gold, mercury, and black sand, into this washing machine, which I bought at a department store. It is really a small hand dry-cleaner for clothes, but it is just what I want."

He showed me a small cylindrical drum, which was mounted in a frame. A crank is used to turn the drum end over end.

"Churning the mixture around and bringing all the gold into contact with the mercury cleans up all the fine stuff. Next, I dump the contents into a chamois skin and squeeze out the mercury, leaving the black sand and the larger particles of gold behind. These can easily be panned. In an iron pot I heat the mercury over a gasoline stove until it vaporizes and passes out through an iron tube into a glass of water, where it recondenses. The gold is left behind in a pure state."

Reading the location notice of a mining claim. These notices are put in a tin box and buried at the foot of location pole after the four corners of claim have been marked with stones

Attracted by a sign at the head of a chute, heralding the fact that here was the "Baby Comstock" mine, I climbed high up the canyon wall, to a mine where I found a little, middle-aged man shoveling dirt in a very businesslike fashion.

"Me a minin' man?" he answered my query, leaning on his spade. "Yes, I'm a miner—all of ten weeks now. Before that, I'd been a sailor all my life. Now it's a simple case of 'root, hog, or die!' so I'm rootin'. For ten weeks I've been shovelin' dirt down this chute, and here's my pay."

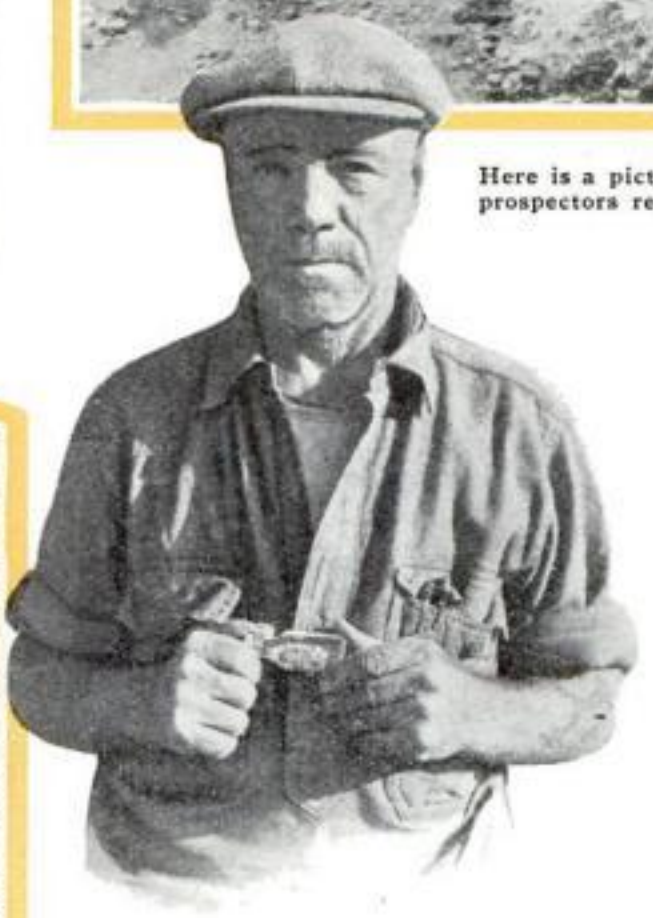
He exhibited a small bottle containing a few flat nuggets and some dust, totaling perhaps an ounce or two.

"Not much for the work, but I don't mind that. The worst is the fare I have to eat. It's beans for dinner, for supper, for breakfast, and between meals. It's hard, even for a seafarin' man. It's only hope that keeps us going.

"One thing that helps us, is toorists. If you put a nice nugget and a little dust in a bottle with some water, a toorist will sometimes pay several dollars for it—more than you can get by selling it in town to somebody who will discount it four or five dollars to the ounce for his trouble. Of course, the mint pays $20 an ounce for it, but you must have at least two ounces at a time."

Directly across the canyon, at the top of a shoulder where once the old stream made a bend, is a mine that has averaged an ounce a week during the ten weeks it has been worked. "These are but the leavin's compared with what used to be," said the owner. "Forty years ago, in this same spot, two men took out a fortune, and just above here, one man took out two pounds of nuggets—$800 worth—in two days, just diggin' them out of cracks in the rock."

Here is a picture of the world's first school for women gold prospectors recently opened outside of South Denver, Colo.



This miner has put his tiny nuggets of gold and dust into small bottles, some of which are sold to tourists at high prices

Down this long chute slides the dirt dug out of the mine high up the hill. The chute carries it to the sluice box where it is washed for gold

In the various canyons where the activity is greatest, I found people of all occupations. Disguised behind a luxuriant growth of whiskers was a movie projectionist who was cherishing a scheme to rig up a cable and bucket system and tap a small spring as a water source. That was all that was necessary, he said, to convert a claim he had staked out in one of the more remote canyons into a paying proposition.

His partner is a man who for twenty-five years has stood behind a barber's chair. "The worst thing about this business," he said, "is that it takes capital to do it right. Even if you are going out on a very small scale, you need about $25—fifteen to buy a couple hundred feet of pipe and the rest for grub enough to last until you can bring in your first gold. Otherwise, you have to do your mining within carrying distance of water, or work right in the stream bed."

Camped beside them was a roughly dressed man, the superintendent of a large manufacturing concern in the city. He proudly exhibited a vial containing several small nuggets and some gold dust—the result of three week-end trips to near-by mining centers, where he had washed out about $20 worth of gold. More than the gold, he valued the exercise and the coat of tan the outdoor life was bringing.

Women and children, too, learn to pan for the yellow metal. Whole families work together, using sluice box, rocker, prospector's pan, and even skillets and washpans. In the Randsburg mining district, two women operating in old diggings long since abandoned have been working for several months and have not only made their living, but have banked $180 besides. In the Mother Lode region of northern California, the three Gilbert brothers are operating a hardrock mine, doing the pick and shovel work below ground while their wives operate the hoist.

While I visited the San Gabriel canyon district, near Los Angeles, one woman miner tipped a wheelbarrow load of dirt into a sluice box and uncovered four glittering nuggets. Elated, she rushed back to the tunnel for another load. Another miner followed her in with his wheelbarrow, when to his horror the roof of the unbraced tunnel gave way and collapsed, burying her in the cave-in. Before she could be reached, she was dead.

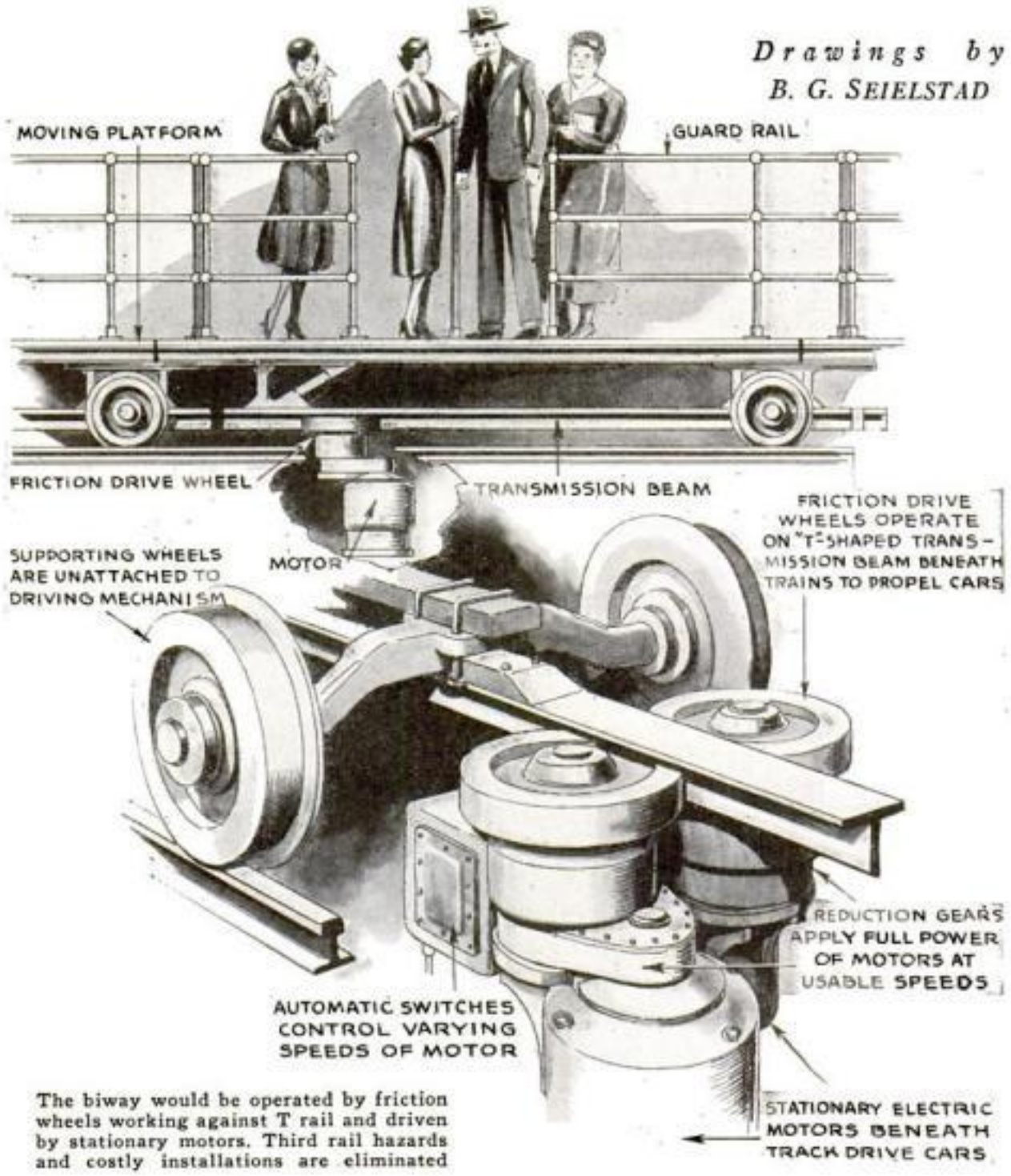
The lure of gold brings hundreds from the city on holidays and week-ends. Many of them are anxious to try out pet theories or apply knowledge gained through study. The University of Southern California has a large evening class in "Elementary Gold Mining and Prospecting." After studying principles and theory, members of the class make field trips to apply their knowledge. Class instruction is also given by a Los Angeles assayer, who for five dollars' enrollment fee gives a fourteen-hour course in minerals, geology, mining law, and assaying.

In the desert regions where water is too expensive to be used for washing, the miners resort to the dry washer, which they usually build themselves. This machine consists of a hopper and a slide or slanting trough, into which are set a series of crosspieces or riffles. The paydirt is shoveled into *(Continued on page 111)*

Merry-Go-Round

Amazing New Plan for Transit System Loads Express Trains, That Never Stop, from Moving Locals

Drawings by B. G. SEIELSTAD



The biway would be operated by friction wheels working against T rail and driven by stationary motors. Third rail hazards and costly installations are eliminated

A RAPID transit system without motormen or conductors, without stations, and with endless chains of express cars that never stop though passengers change from locals to expresses and back again, is the sensational solution for the traffic problem in big cities offered by Norman William Storer, Westinghouse engineer.

His plan is to have two continuous moving sidewalks, broken up into twelve-foot sections to facilitate rounding turns, operating side by side. Hence the name of his system, the "biway." One chain of sections or cars will form a nonstop express, the other moving platform a local that halts once a minute for ten seconds to take on and discharge passengers at the stationary platform that will encircle the entire loop of the city-wide system. Entering or leaving the local will be like stepping on or off a merry-go-round, and can be done at any point along the whole circular line. The capacity of the system would be far beyond that of existing subways.

In a ride on an underground biway, as visualized by Storer, you will wait at a point on the platform for forty seconds or less, until the circling sections of the local platform slow down to a stop. Gates swing open. You step onto the section in front of you, a gong sounds, and the gates swing shut. There are no seats on the local, as you remain on it for only a few seconds. On the opposite side from the platform, you see the express cars flashing past in a steady stream. Your moving platform gains speed. The express seems slowing down. Thirteen seconds from the start, both trains are running at exactly the same speed on the parallel tracks. Gates swing back on the local, doors slide open on the express, and you step across and take a seat for the main part of your journey. The doors close and the local begins slowing down for another stop while the express speeds on.

Electric signs in each car tell you where you are and when you need to change back to the moving platform to stop at a given destination. Changes to and from the express are made every fifty seconds. You can get off at any point and get back on the biway without extra charge.

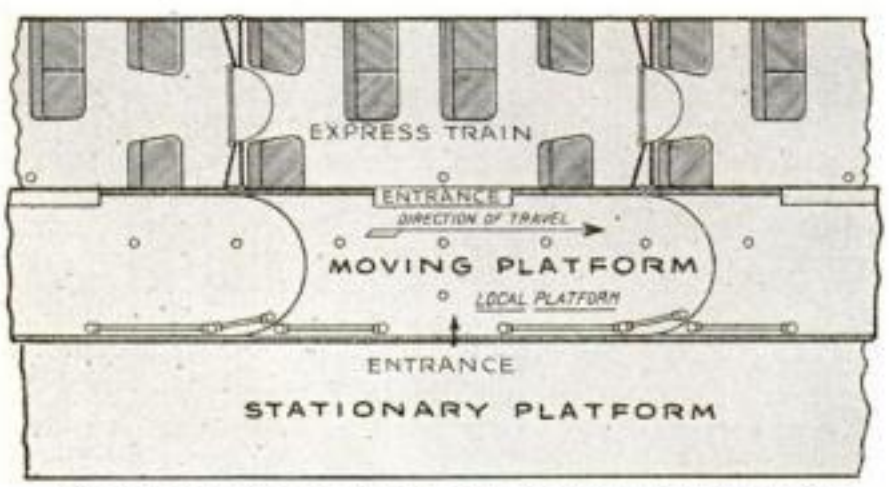


Diagram of stationary, moving, and express platforms, showing how easily and safely a traveler could pass from one to the other

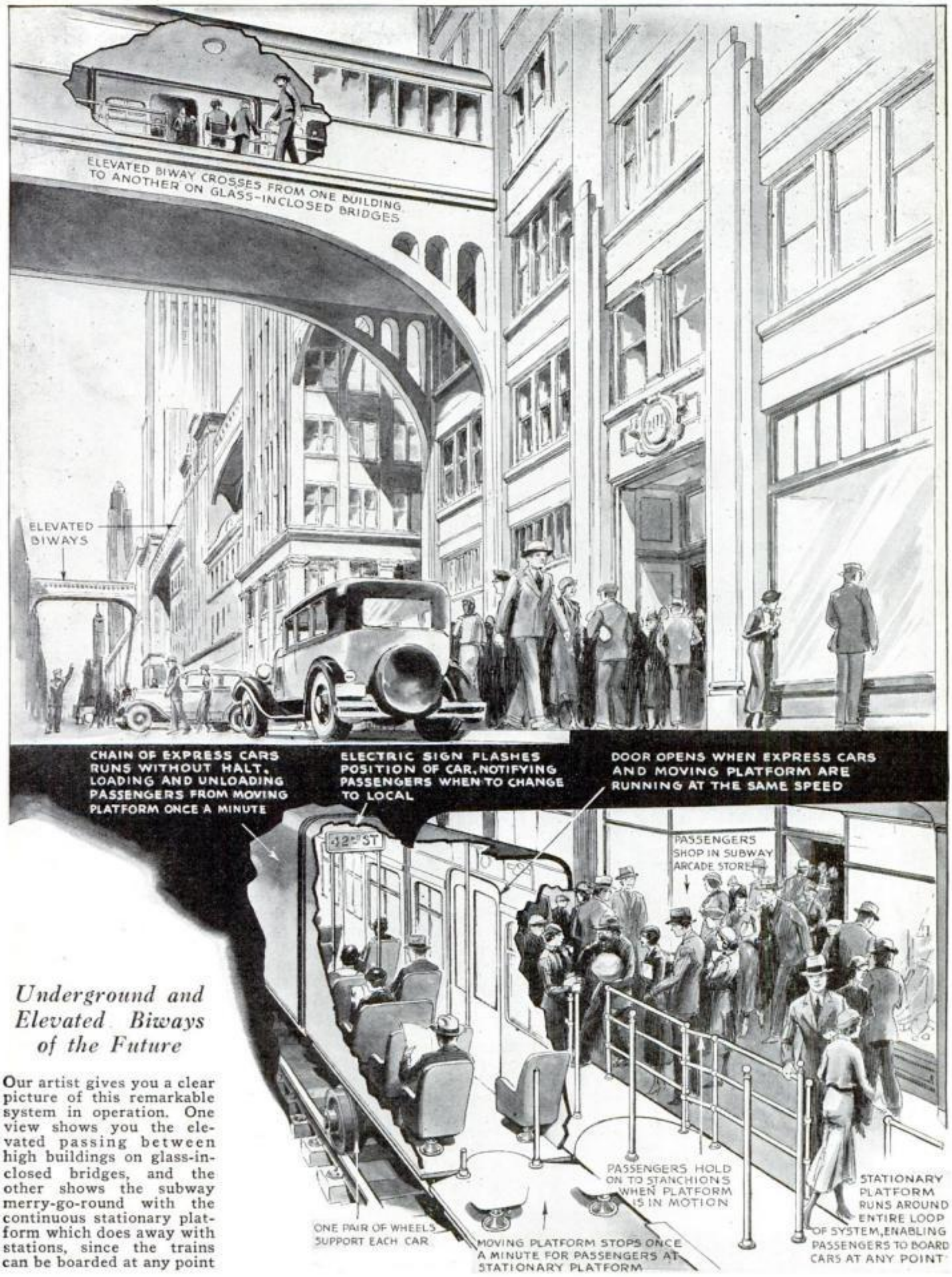
At 1,000-foot intervals, pits beneath the tracks contain stationary electric motors that drive the trains by applying power to "T" sections running beneath the cars. Starting and stopping is governed automatically and switches at frequent points along the route enable attendants to stop the system instantly in case of emergency. Repairs and adjustments are made between two and six A. M., when traffic is at a minimum. Both the express and local operates with a regular rhythm of increasing and decreasing speed. While the local is speeding up to seventeen miles an hour, the pace at which passengers are exchanged, the express is slowing down from twenty-two miles an hour, and while the local is slowing to a stop, the express is advancing its pace to twenty-two miles an hour again.

This wavelike use of power reduces the size of the motors required, since one train is always slowing down as the other is speeding up and full power is never needed by both at once.

Under each car or section is a single pair of wheels, placed near one end. The weight of the free end is supported by the wheels of the next section. As both trains and the stationary platform are continuous and the car floors cover the entire track space, it is impossible for a passenger to fall off.

The cost of constructing a biway, Storer says, will be only two thirds that of an ordinary subway, while the operating expense will be but a small fraction of present costs. In districts filled with skyscrapers, it is planned to construct the biway as an elevated, running it through buildings and crossing it from one structure to another on glass-inclosed bridges.

Subway *for* City Travel



Underground and Elevated Biways of the Future

Our artist gives you a clear picture of this remarkable system in operation. One view shows you the elevated passing between high buildings on glass-inclosed bridges, and the other shows the subway merry-go-round with the continuous stationary platform which does away with stations, since the trains can be boarded at any point

Tests with chimpanzees, like the one shown below, indicate that these big apes learn certain simple things easier and quicker than human babies of same age or slightly older

Putting pegs in holes, as illustrated above, is one of the tests used in gaging manual dexterity of young children and of apes. At this apes prove more apt

TESTS SHOW

Apes *Learn Faster than* Babies

MONKEYS are smarter than babies! That is the startling conclusion reached by Dr. W. N. Kellogg, Indiana University psychologist, after a nine-month experiment in a bungalow-laboratory in Florida.

During that time, a young chimpanzee, seven and a half months old, and the scientist's ten-months-old son lived together, ate together, wore similar rompers and shoes, kept the same hours, and received identical treatment, while the psychologist studied their behavior and development. The results showed the baby monkey surpassed the human infant both in ability to remember and to grasp new knowledge.

In one test, Dr. Kellogg tied slipknots on the hands and feet of the child and the chimpanzee. Then he timed them with a stop watch to see which would untie the knots quicker. The chimpanzee won. It also mastered the use of a hoe and rake first and was victor in a blindfold test in which the two were placed in a ten-foot square with hoods pulled down over their heads and watched to see which would move in the straightest line toward someone calling from outside the square.

A "show me your nose" contest ended in a draw, both pointing to their noses in about the same time. The ape demonstrated it could remember for half an hour by which door a person left a room, while the child could remember for only five minutes. At one time in the test, the chimpanzee proved it understood a larger number of words than the baby. Toward the end, the child gained the advantage.

One explanation of the results, Dr. Kellogg points out, is the fact that a chimpanzee has a shorter life and consequently matures earlier than a man.

In three laboratories—one in New Haven, Conn., one in Florida, and one in Africa—Yale scientists are seeking new facts about the capacities of "animals that think." Scores of their experiments have shown that great apes can solve problems that require logical deduction.

In one of the tests, scraps of food were placed in a hollow tube and a pointed stick left near by. It was only a few minutes before the reasoning ape had begun to poke out the food with the stick. Another time, a banana was hung from the ceiling of a cage. To reach it, a chimpanzee had to build a little stairway from boxes of consecutively decreasing size. As a memory test, an investigator placed food in one of four differently-shaped boxes in the presence of several apes. Later, when the boxes were returned to the cage in different positions, the animals immediately approached the right one.

However, when boxes of the same size and shape, but of different colors, were employed in the test, the monkeys were confused. Their eyes required considerable training before they were able to distinguish special colors.

An interesting discovery about the eyes of monkeys was reported recently by a Melbourne, Australia, biologist. Like those of men, he says, they can be focused for different distances, while all other animals lack this ability.

Supplementing the ape studies of the Yale psychologists are others being conducted at the university upon children less than a year old. By means of moving picture cameras, "one-way" windows, and a huge screened-in photographic dome, the experts are watching and recording the reaction of babies to various situations. The screens are coated with dark paint on the outside; light paint on the inside. As a result, observers can watch what goes on inside the dome while the illumination within, reflecting from the light inner surface, prevents the babies from seeing out through the screens and realizing they are being observed.

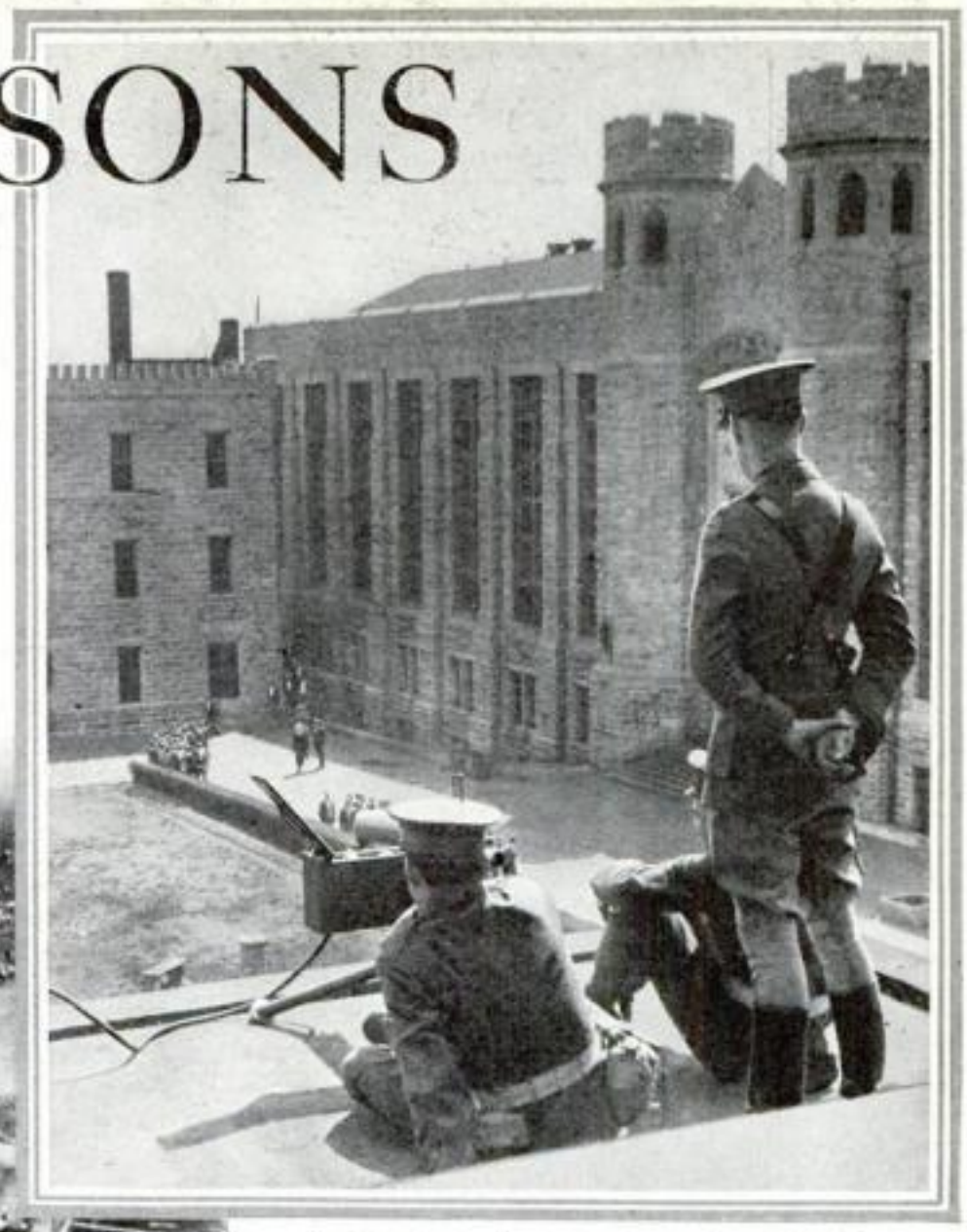
One mystery in connection with the behavior of human infants has just been given an ingenious explanation by Dr. A. G. Morison of the Health Department of the city of Bristol, England. From time to time, children have begun to talk in a mysterious language of their own which nobody could understand. "Word deafness," or an inability to register the sounds of words in the brain although the hearing is normal, is the cause, Dr. Morison suggests. Retaining visual word memories but not auditory ones, the children make up words based on what they see. It is such "lip-reading words" that form the vocabulary they use and which no one else can understand.

For several years, Dr. Ales Hrdlicka, anthropologist of the Smithsonian Institution, Washington, D. C., has been studying babies who act like animals—walking on all fours, picking up objects with their teeth, or snapping at people's legs when angry. As a result of his investigation, he has found they are almost always lonely children who have no human playmates and associate with animals, such as cats, dogs, or pigs, until they consider themselves animals rather than humans.

New Prisons

ARE PROOF AGAINST

Riot and Outbreak



At left, fire raging in Auburn prison, New York following serious mutiny among prisoners. Above, members of the state troopers policing Missouri State Prison after an attempted jail break

By EDWIN W. TEALE

STREAMER headlines and front-page stories in thousands of papers startled the country, some months ago, when the worst epidemic of prison riots in history swept the United States.

Revolt at Auburn Penitentiary, N. Y., burst with the suddenness of a thunderclap. Hurling acid into the eyes of a guard, a trusty wrenched away his keys to the arsenal, passed riot guns and revolvers to the frenzied inmates, and started a five-hour reign of terror. At Fort Leavenworth, Kans., 3,000 prisoners stormed the gates and battled guards and troopers; and, at Canyon City, Colo., armed desperados killed seven guards, barricaded themselves in a cell block, and shot it out until their stronghold was demolished by dynamite.

In Illinois, in Rhode Island, in Colorado, in Kansas, in New York, such mass attempts at escape wrote frightful pages into the record of American prisons. Culminating this story of violence and bloodshed, came the ghastly prison fire at Columbus, Ohio, where 319 men lost their lives in the flames.

Public attention was thus focused upon prison conditions. Inventors, architects, scientists, and manufacturers started a campaign to make prisons safer and stronger. What have they accomplished?

To find out, I recently interviewed a number of the men engaged in the movement. From them I learned of the progress that has been made—of ingenious mechanisms, scientific devices, radical changes that have been worked out and of which the general public has heard little. I learned of new concrete block walls harder to tunnel through than solid stone; of cell doors moved and locked from distant towers; of "invisible guards" using light-sensitive metals to keep tab on prisoners; of super-power tear gas developed for riot use; of "skyscraper" jails and of strange "beehive" prisons.

In this advance in construction and design, workers have kept in mind the craft and cunning of the criminal. The most innocent object may become an instrument of escape in the hands of the expert jail breaker. One prisoner, for instance, unraveled a thread from his sock, dipped it in varnish, and rolled it in emery dust to produce a makeshift file. In this way, he actually cut through steel bars with a cotton thread!

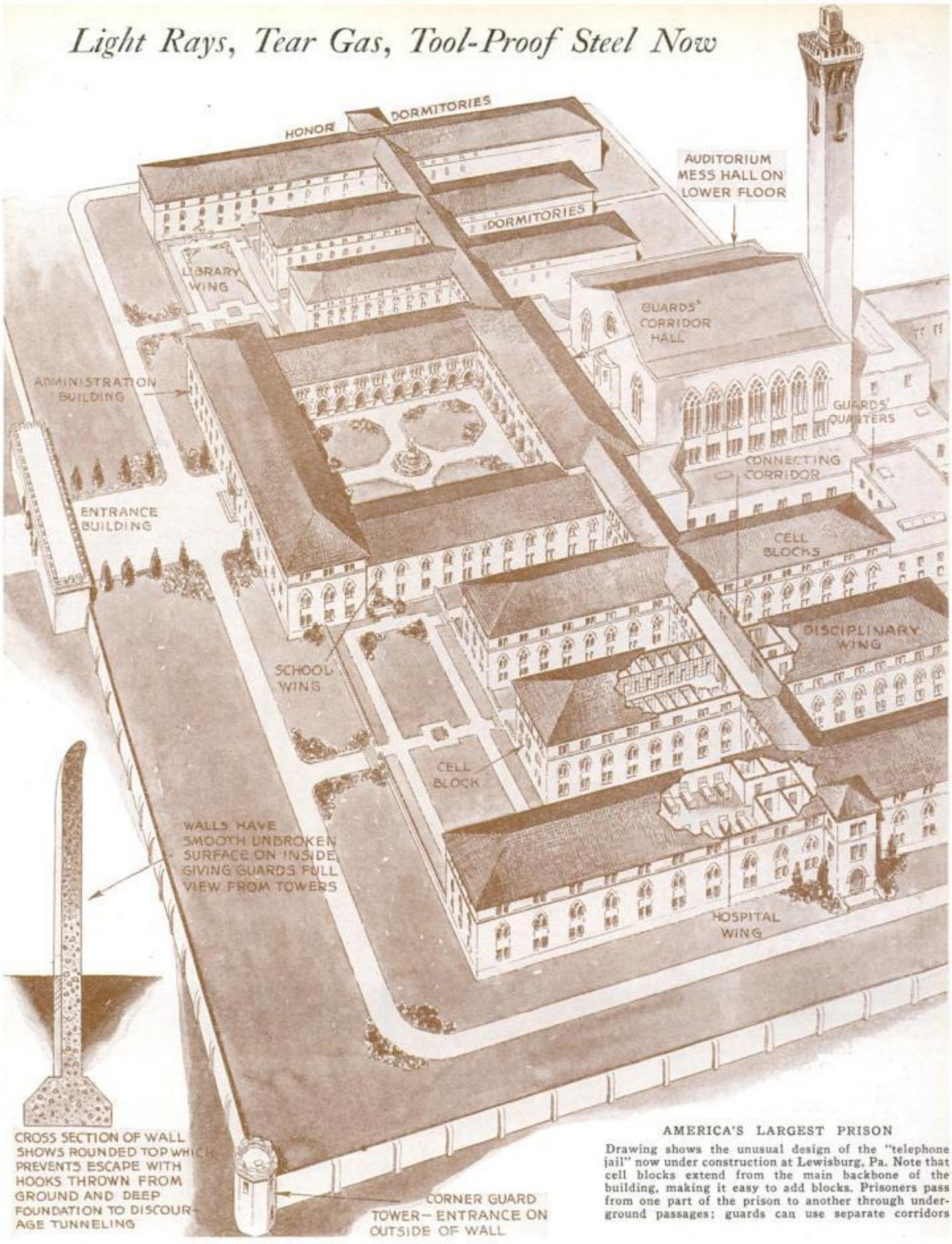
In another case, a convict found a rusty buttonhook in a pile of refuse. He spent months pounding it with stones and filing it, by rubbing it along a concrete floor, until he had fashioned a crude key that opened the door of his cell. At Fort Leavenworth, desperate killers leaped into the cab of a locomotive that had brought freight into the prison yard, overpowered the crew, opened the throttle, and crashed like a battering ram through the penitentiary gates to freedom. But the strangest case of all, probably, is that of a burglar who escaped from prison with the aid of a decoy duck!

He was allowed to whittle out the wooden bird as a "harmless hobby." Then one day while working outside the walls as a trusty, he tied a rubber hose to the decoy, slipped into a stream, and, breathing through the tube, traveled underwater like a submarine until he was out of sight of the penitentiary.

ONE of the most famous cell blocks in the world is in the Sing Sing death house, at Ossining, N. Y. In more than forty years, only three men have escaped. In 1916, "The Paper Box Kid" shot his way to temporary freedom and, earlier, two New York City murderers, Tom Pallister and Frank Roehl, battered their way out in a sensational jail break that illustrates the worth of a recent improvement in prison building.

A booming forty-mile-an-hour gale was pounding the roof of the death house on the night of their escape. When change of watch occurred in the evening, the night guard found Roehl curled up on his couch, complaining that he had been sick all day

Light Rays, Tear Gas, Tool-Proof Steel Now



AMERICA'S LARGEST PRISON

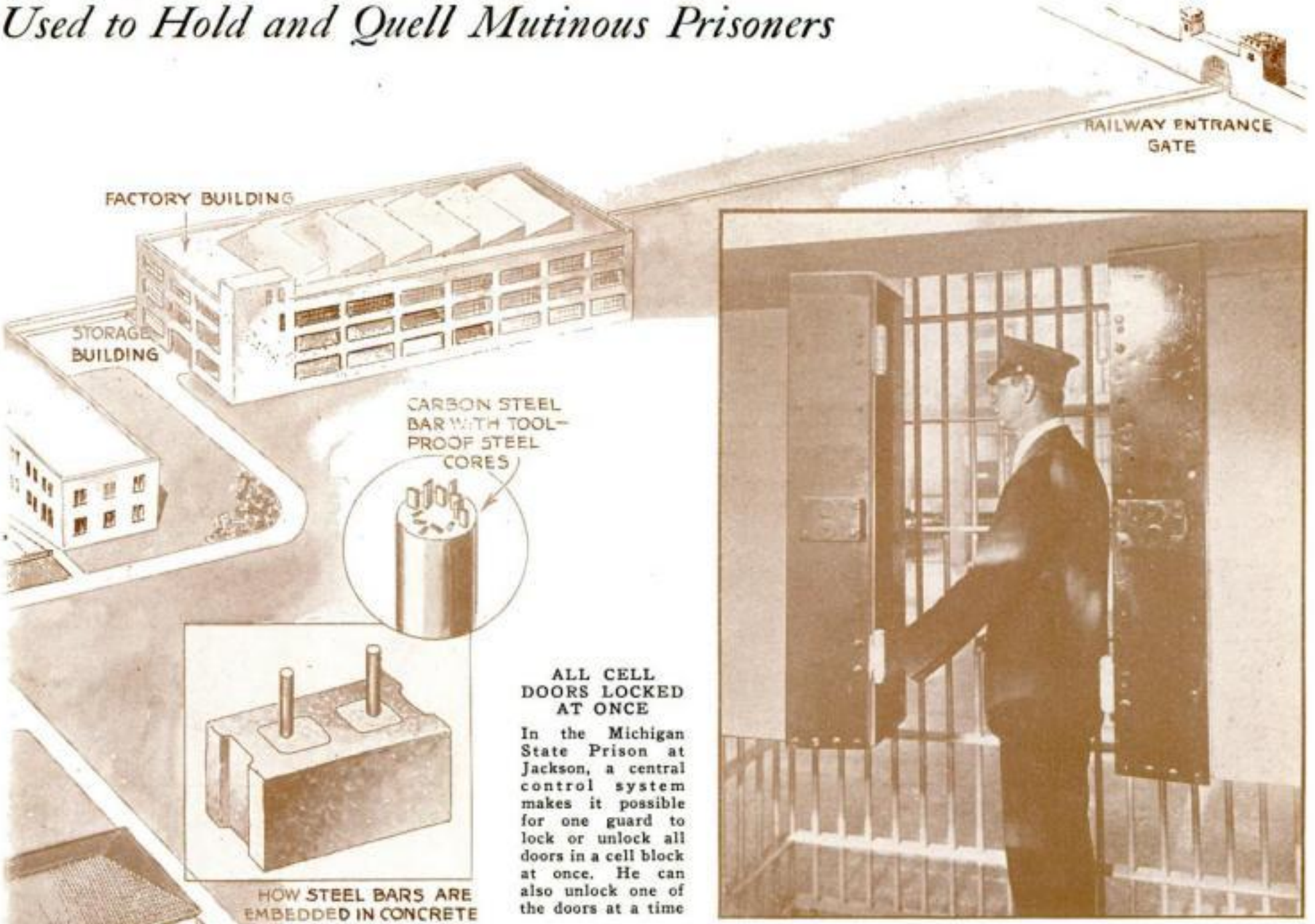
Drawing shows the unusual design of the "telephone jail" now under construction at Lewisburg, Pa. Note that cell blocks extend from the main backbone of the building, making it easy to add blocks. Prisoners pass from one part of the prison to another through underground passages; guards can use separate corridors

and was very weak. Half an hour later, the condemned man sat up unsteadily and asked if he could have something to eat. The guard brought bread and a cup of milk on a tray. Unable to pass it through the bars, he unlocked the cell and approached the couch.

He was stooping over to set down the tray when Roehl uncoiled like a steel spring. His right hand shot up, the widespread fingers jabbing into the eyes of the guard, sending him staggering back helpless. In an instant, the convict had jerked away his revolver and keys, locked him in the cell, and was on his way to free Pallister, his confederate in the plot.

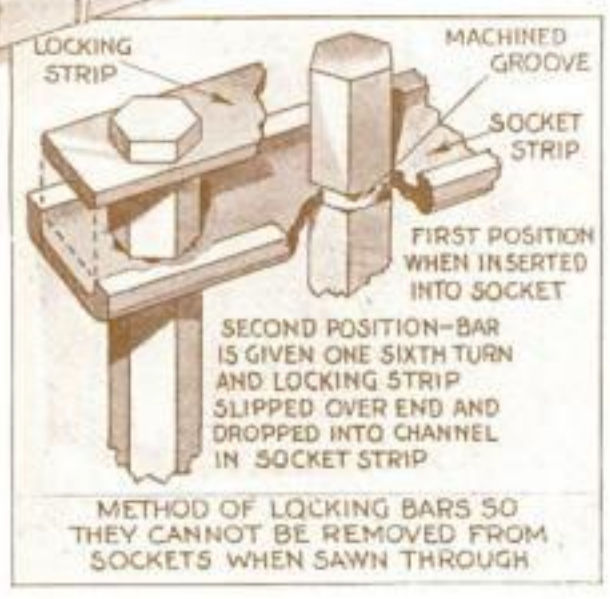
Pallister, once a mason, had been "sent up the river" before on a burglary charge and at that time he had actually helped in the construction of the death house in which he was confined. He knew by heart the strong and weak places in its joints and masonry. Using a poker and heavy fire shovel, the two men set to work, pound-

Used to Hold and Quell Mutinous Prisoners



ALL CELL DOORS LOCKED AT ONCE

In the Michigan State Prison at Jackson, a central control system makes it possible for one guard to lock or unlock all doors in a cell block at once. He can also unlock one of the doors at a time



METHOD OF LOCKING BARS SO THEY CANNOT BE REMOVED FROM SOCKETS WHEN SAWN THROUGH

ing away at a point indicated by Pallister. The howling of the gale drowned the sound of the hammering. In the end, they battered out a small opening, wriggled through, and, hunching low against the wind, zigzagged across the roof, gained the prison wall unseen, and dropped into the water of the Hudson River.

Masonry of a new type, making such escapes impossible, has been adopted for the first time in the Berks County Prison, just completed at Reading, Pa. The architect who designed the building was Alfred Hopkins. At his New York office, the construction of the ingenious "block and bar walls," which were used, was explained to me. Ordinary concrete blocks were employed. After they are in place, rods of special tool-proof steel are inserted vertically, six inches apart, in the holes in the blocks, which are then packed with extra-hard cement. The result is a wall that appears to be of ordinary concrete block construction but is more assault-proof than solid stone.

By this and other innovations, I was told, the present cost of prison building has been cut from between $4,000 and $5,000 per inmate to approximately $2,000. Thus, comfortable housing for twice the number of prisoners can now be provided at the cost of one in the older institutions that employed steel plates to protect cell walls.

A few days ago, nine long-termers at the Arizona State Penitentiary sawed their way through prison bars and made a successful dash for liberty. At an Eastern jail, recently, a guard was making his rounds examining cells when a steel bar at one window came off in his hand. The inmate had sawed practically through in two places, filling the cuts with bread crumbs and lampblack so they would not be noticed!

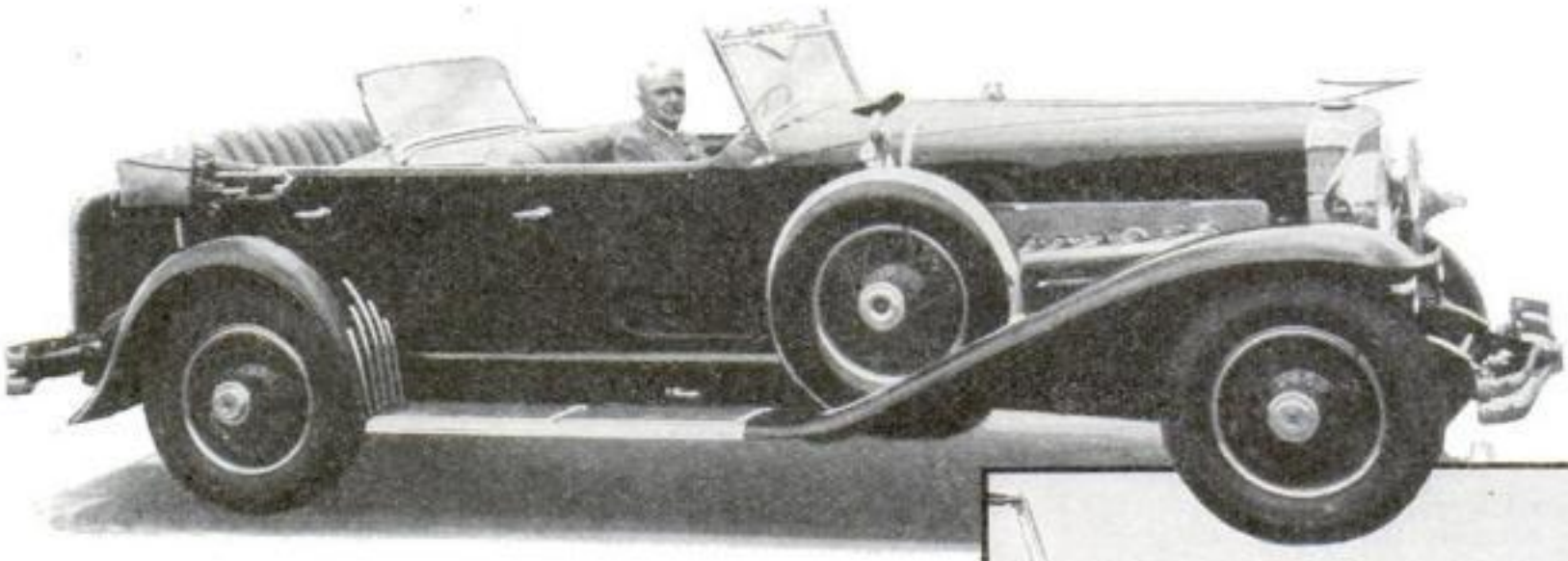
IN THE past, saws have reached convicts hidden in magazines, secreted in the stems of pipes, stowed away between layers of leather in shoe soles. Because prisoners hide saws, files, and other contraband behind heating radiators in their cells, modern prisons are frequently supplanting them with straight steam or hot water pipes. The problems of protecting steel bars and grilles from smuggled cutting tools has received special attention in recent months.

One cell window, just put on the market, is so arranged that it gives the guard immediate warning if such secret cutting begins. The maker, with whom I talked, pointed out that the glass panes fit into the framework of hardened steel bars in such a way that sawing cannot begin without breaking out a pane of glass, and this reveals the attempt to the guard the first time he passes the cell.

For nearly ten years, this manufacturer worked to perfect the window by submitting experimental models to convicts noted as "ironworkers" and escape artists. Provided with tools, they were left alone with the invention. Time after time, they discovered weaknesses the engineers had overlooked. Finally, the present form was evolved, baffling the prison veterans who tackled it.

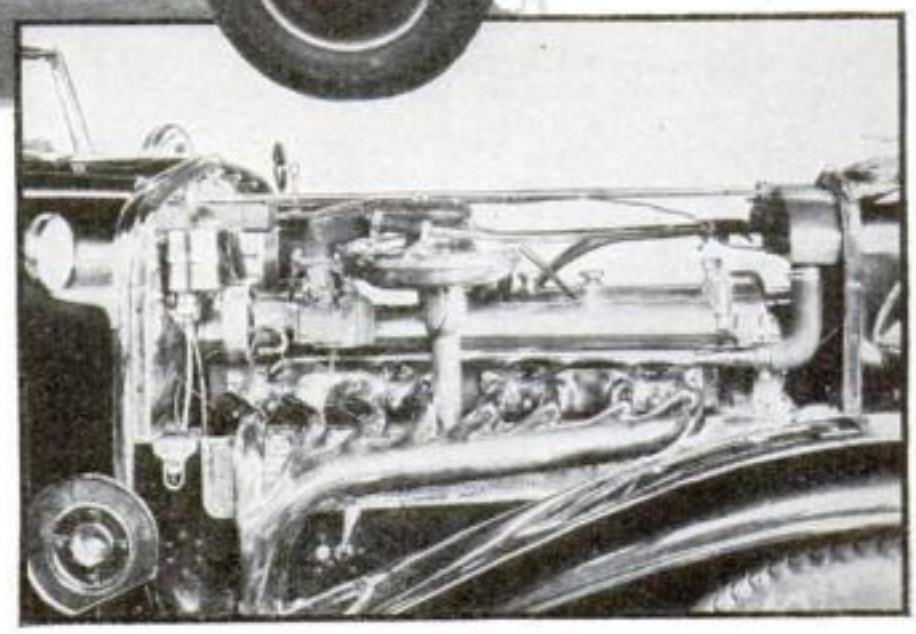
A simple change in the placing of prison bars has recently been introduced as the result of *(Continued on page 106)*

Most Powerful Car for Private Use Develops 320 Horsepower



Here is the most powerful passenger car ever built in America. Its motor develops 320 horsepower and the car has gone 130 miles an hour in test runs

CAPABLE of more than two-mile-a-minute speed, a sport car just placed on the market is called the most powerful passenger automobile ever developed in America. A supercharger, adapted from use on racing cars, forces a fuel mixture into the intake manifold, and enables the motor to develop 320 horsepower. The car has been clocked at 130 miles an hour with its throttle not all the way open, but the real value of the motor's power lies in the amazingly fast getaway and the remarkable hill-climbing ability that it provides.



This close-up of motor for most powerful car shows the supercharger just above the center of the cylinder block. Its whirling blades force fuel forward under pressure

BIG PNEUMATIC MITTS HELP BATHERS SWIM

TIMID bathers are made more confident by "pneumatic mitts," inflated with air and worn on the forearms. With this aid a swimmer is buoyed up and finds no difficulty in keeping his head out of water. An air valve opens for inflation when the sides of a perforated disk are squeezed between the thumb and first finger.

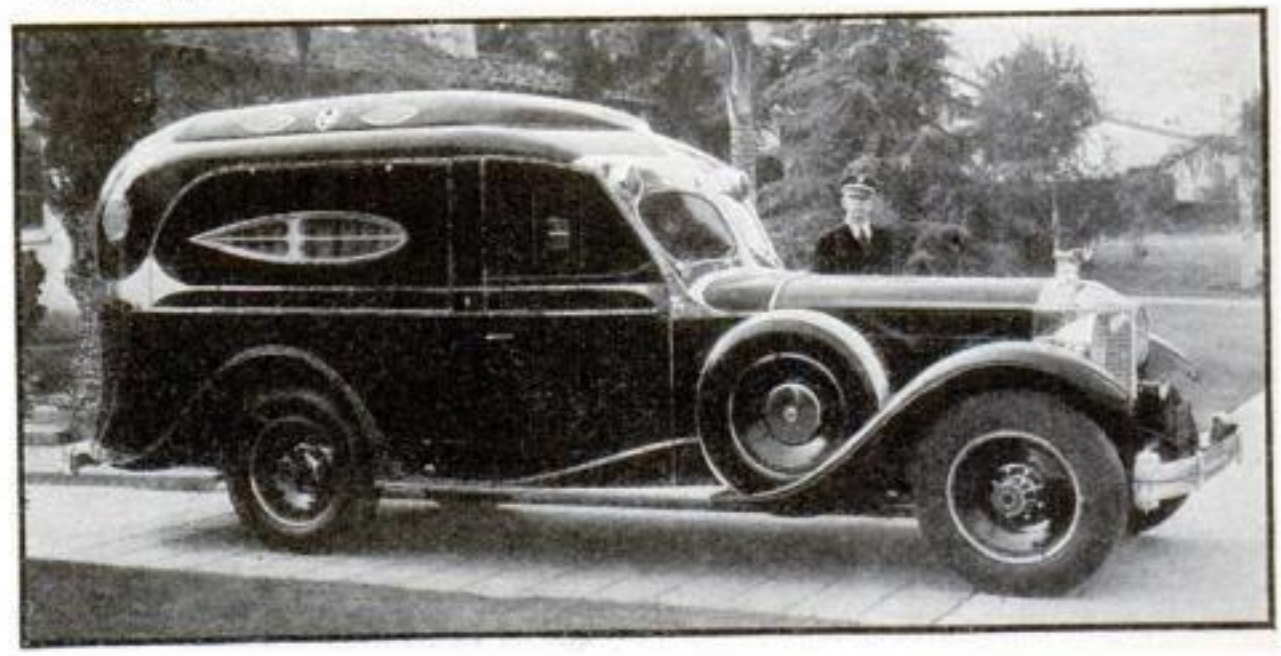
COMFORTS OF HOME PUT IN VACATION TRIP CAR

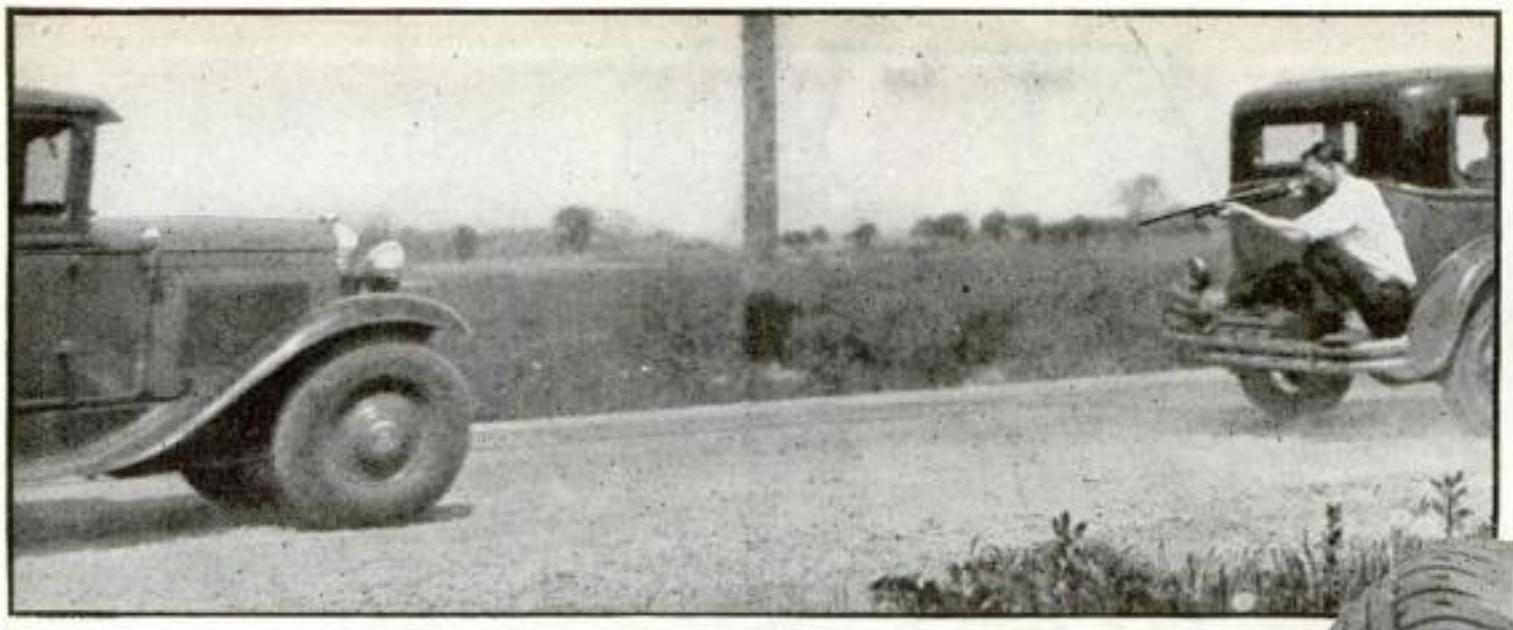
FOR his transcontinental vacation trips, a Grand Rapids, Mich., showcase manufacturer had the unusual motor car pictured at the right built to his order. The passenger compartment contains sleeping facilities, fans, a bookcase, and a dressing table. Sliding sides may be let down to permit enjoyment of the view. Insulation within the body shields the occupants from heat and cold.

ARTISTIC ROBOT DRAWS PICTURES

Pictures apparently are drawn by this robot, but an artist helps

A ROBOT that draws pictures on an easel, apparently with no human hand to guide it, was devised recently by a Hartford, Conn., inventor to serve an advertising purpose. Actually a real artist behind the scenes traces the drawings with a stylus, to which the puppet's right hand is connected by wires and rods running through the three legs of the stool. A hidden mirror permits the artist to watch his own work and also his audience. Paper moves across the easel from a roll, and as soon as one picture is done the strip is pulled down and a fresh one exposed.





To test the super-balloon tire, the man with the shotgun blew holes in the tire while the car ran at 45-mile speed. It was stopped without skidding and without bumping on rim

Big Super-Balloon Auto Tires End Blow-Out Accidents

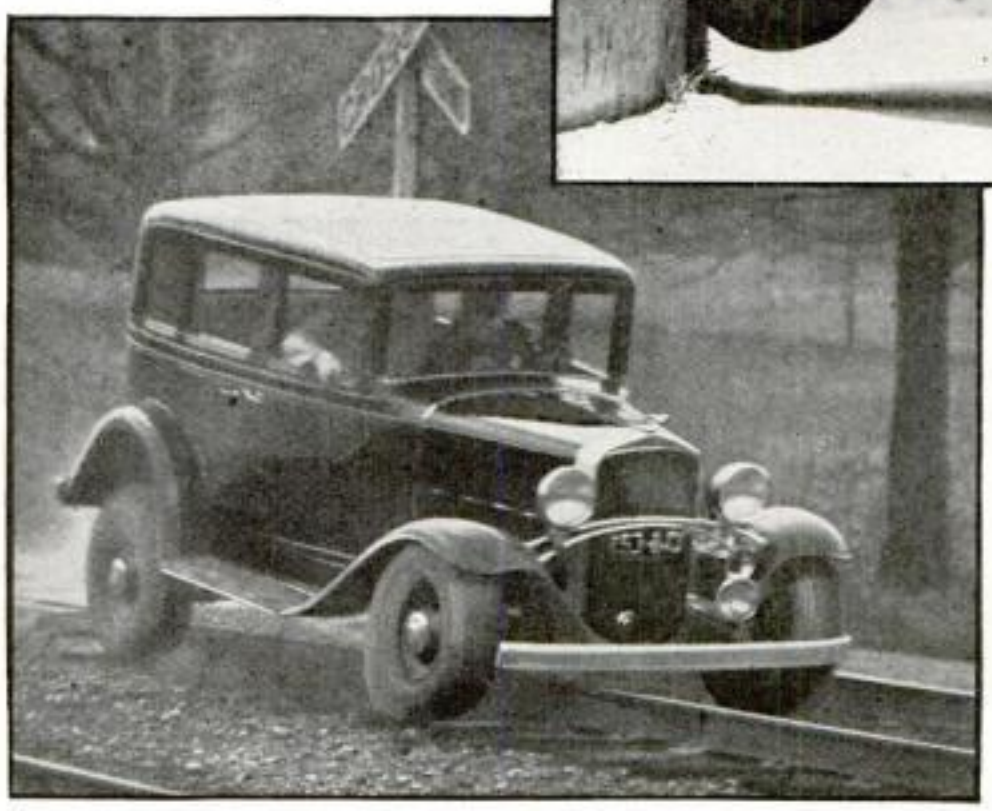
IMAGINE driving at forty-five miles an hour while someone in a car ahead is firing a shotgun at your front tires—and then coasting to a stop, without a bump or a skid, to find a hole in one of them big enough to put your hand through. That startling test was applied successfully, the other day, to a new kind of automobile tire that some manufacturers are already offering as optional equipment on their new cars.

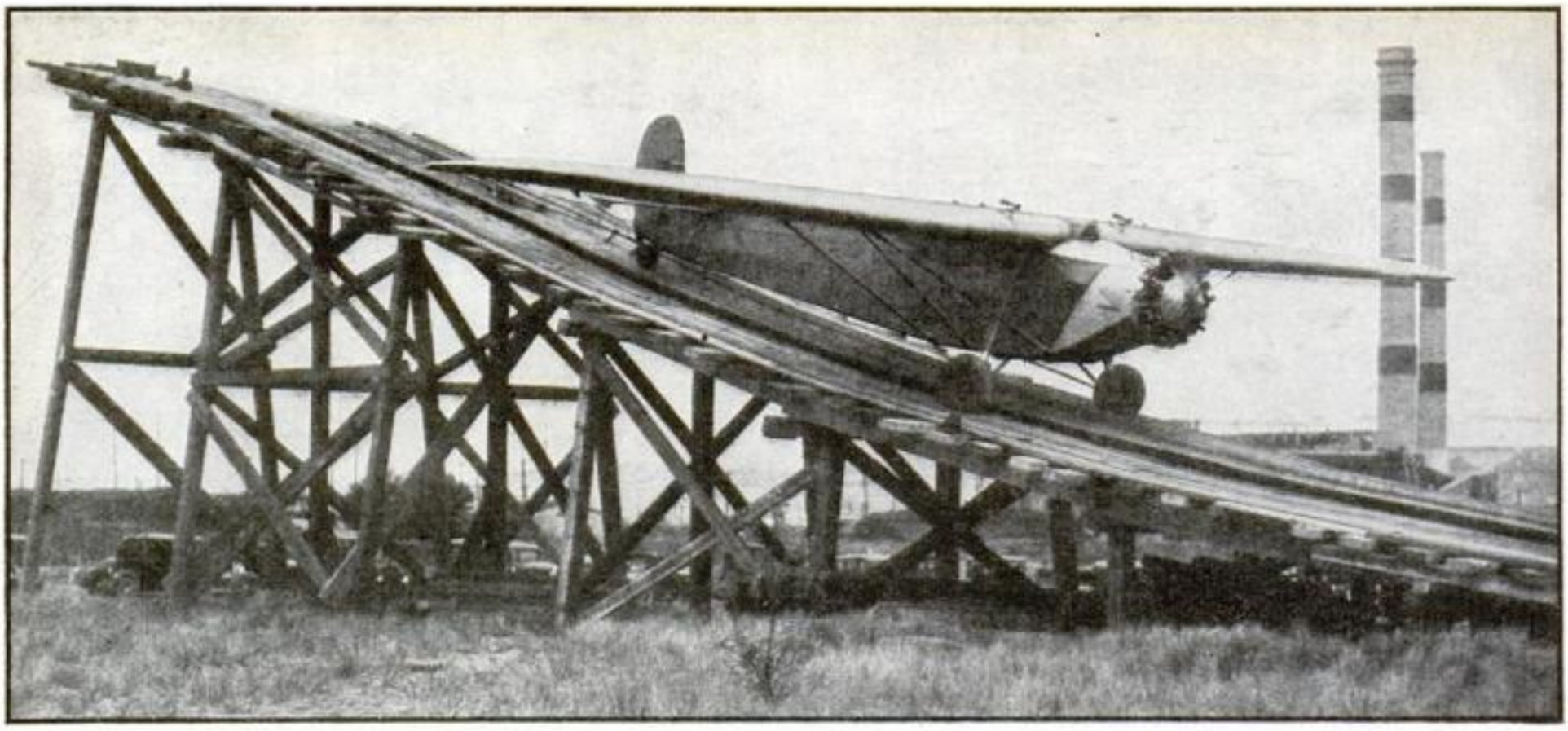
The new super-balloon tires are almost twice as big as ordinary balloon tires and carry a fraction of their air pressure; some of the styles use as little as eleven pounds. If punctured or blown out, the tire, because of its large diameter, does not collapse suddenly, centrifugal force holding the whirling parts outward. Air leaks out slowly even through a large hole because of the low pressure.

At upper right, A. J. Musselman, one low pressure tire pioneer, shows the hole blown in casing with shotgun. At right, examining hole after car was stopped. The nine-inch tire did not flatten out while car was in motion

At left, the big tire takes a high curb at fast speed. Note how tire yields when striking obstruction. Below, a smaller tire taking up shock as wheel strikes rail

Low air pressure in the big tires robs road of bumps and in test, below, auto is driven at 50-mile speed over railroad





Use Inclined Runway to Give Ocean-Flying Planes a Start

CATAPULTS and towing carriages have been used to boost planes into the air more quickly than they could take off unaided, and now comes a "roller coaster" style of runway. The photograph above shows one of these launching devices erected at a Seattle, Wash., airport for use in Pacific flight attempts. With a flying start down the steep platform, a machine carrying a heavy load of fuel for a transoceanic flight can rise after a short run and avoid obstacles at the edge of the field.

STREET GATES SAVE SCHOOL CHILDREN

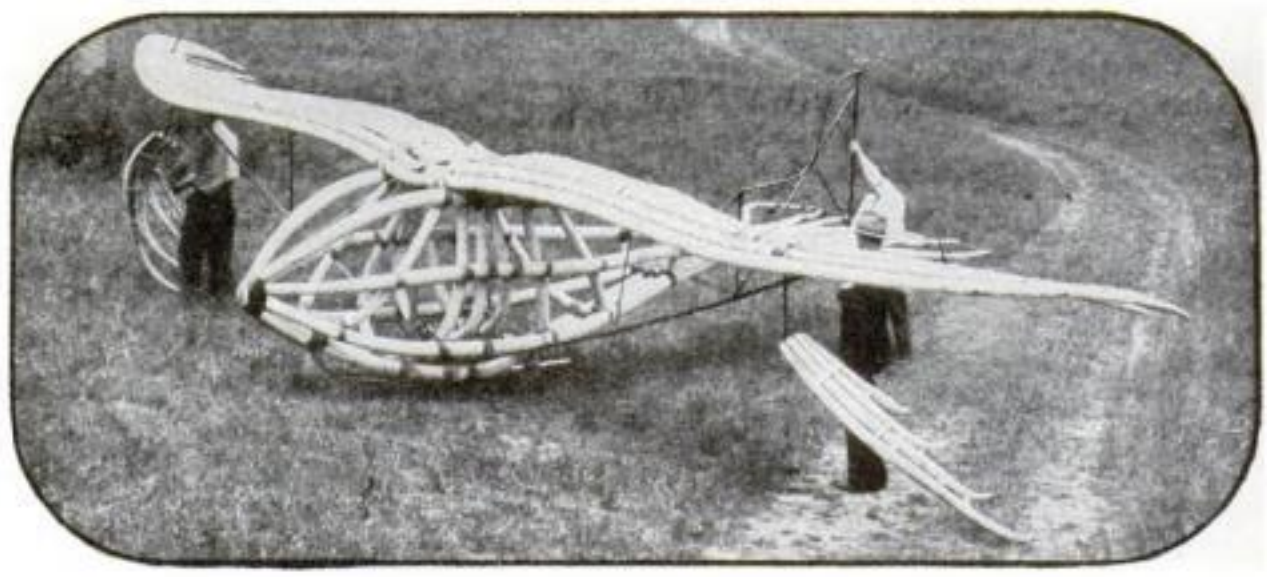
So SCHOOL children may cross streets without accident, on their way to and from classes, a new kind of safety gate has been placed on the market. Installed between the highway curbs wherever automobile traffic is heavy, it holds up the cars while pupils are passing. Stripes and a conspicuous "stop" sign make the device look like the gates used at railroad crossings, but the poles are of light bamboo and are easily operated by a schoolboy. The photograph at left shows one of the first of the new gates in service at a Middletown, Ohio, school, where it is successfully guarding the youngsters' lives and limbs. It is expected that the gates, which will be in operation only a few minutes each school day, will prove especially valuable at congested city corners.

ICE NOW DELIVERED BY REFRIGERATOR TRUCK

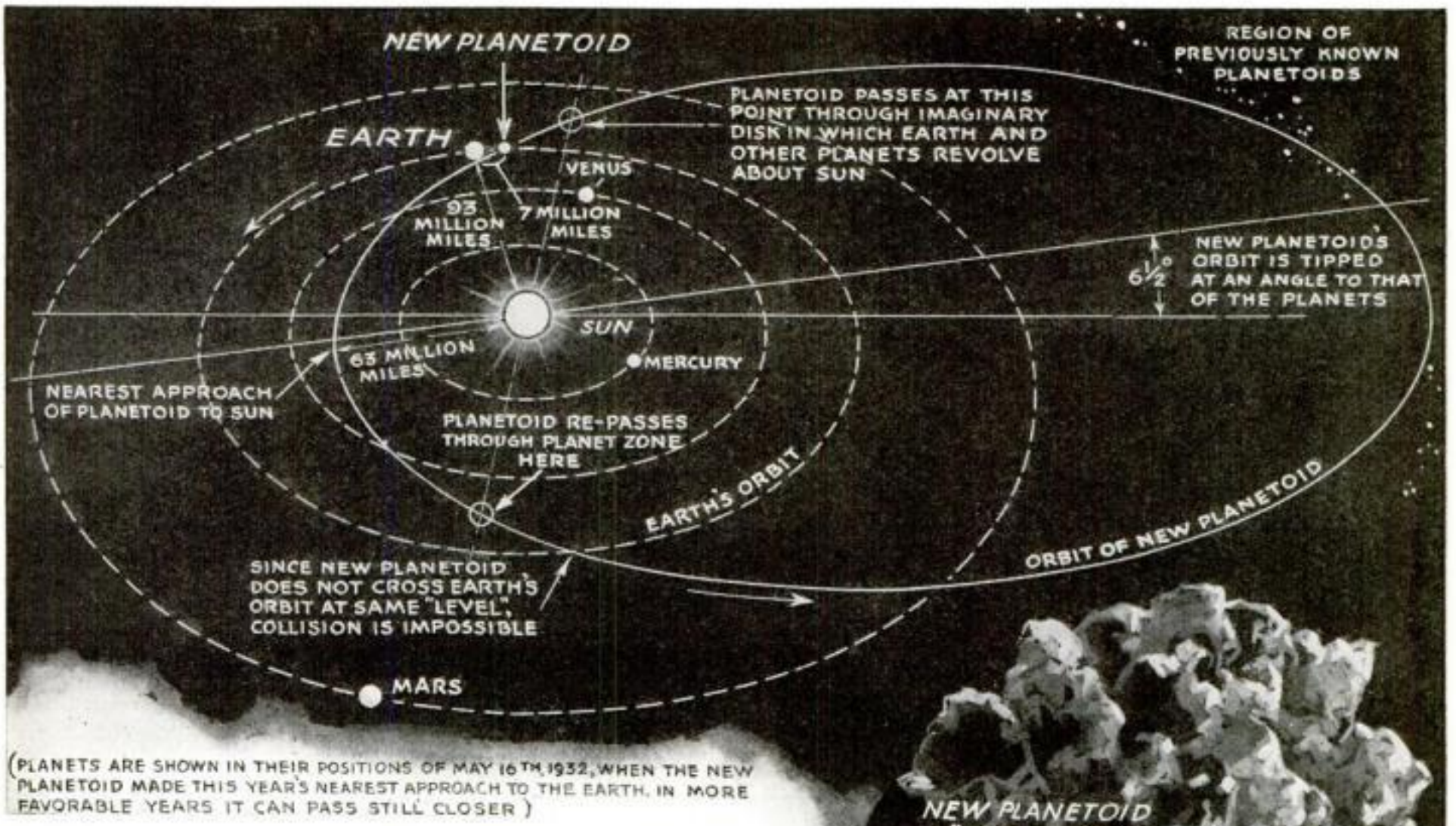
LITTLE does the 1932-style ice man resemble his predecessor. Refrigerated trucks with insulated walls speed the ice to the customer's door, in an ultra-modern house-to-house service just begun by a Los Angeles, Calif., firm. Each block is sawed to exact size, wrapped in waxed paper, and untouched by human hands before it goes in the refrigerator.

HAND LEVERS PROPEL STRANGE RUBBER BIRD

MAN-POWER will help to fly a remarkable glider, the second to be built of rubber by a Washington, D. C., inventor, which will soon have its initial try-outs. Its wings are patterned after those of a bird. Hand levers operate flappers at the wing tips, which aid in keeping the odd craft in the air. As in the inventor's previous model, which was of smaller size and more conventional shape, pneumatic tubes pumped up to the stiffness of auto tires are used for framework. The photograph at right shows the latest model before the fabric covering was attached to the wings.



New Baby Planet Is Close to Earth



Map shows that the newly discovered baby planet swings nearer the earth than any other heavenly body except our own moon. The map is based upon a sketch drawn especially for POPULAR SCIENCE MONTHLY by Dr. Fred L. Whipple of the Harvard Observatory, who was the first in America to see the planetoid

Here is our artist's idea of the planetoid compared with Mt. Washington, N. H., and Empire State Building. Note jagged nature of surface

FOR untold years, the earth has had a neighbor up in the sky and no one ever knew it! A chunk of rock two or three miles in diameter, tiny in size but important enough to be designated officially as a "planetoid" or baby planet, has just been discovered and identified as the nearest thing to us, except our own moon, in the whole solar system. The find is hailed as the most spectacular event in astronomy since the discovery of the major planet Pluto two years ago.

At its nearest approach to the earth, astronomers have figured, the new planetoid is only ten times as far away as our moon. Standing upon it, a man with a pair of field glasses could obtain a good view of the earth, and plainly see its continents. Danger of a collision between it and the earth is averted only through the fortunate circumstance that its orbit is tilted with respect to ours, and the two points where it crosses our "level" are respectively inside and outside the earth's path.

Because the tiny world is one of the smallest in the solar family, it is invisible to the naked eye. Under extremely favorable conditions it could be observed with a six-inch telescope as a faint, starlike pin point of light. The name "1932-HA" has been assigned to it pending selection of a more euphonious title, the number indicating the year of discovery and the letters its code name, in accordance with astronomical custom.

A German astronomer, Dr. Karl Reinmuth of the Heidelberg Observatory, discovered the baby planet a few weeks ago. When he announced the find, American observatories picked up 1932-HA and confirmed its existence. First in this country to see it were Dr. Fred L. Whipple and his assistant, L. E. Cunningham, using the sixteen-inch refracting telescope of Harvard Observatory at Cambridge, Mass.

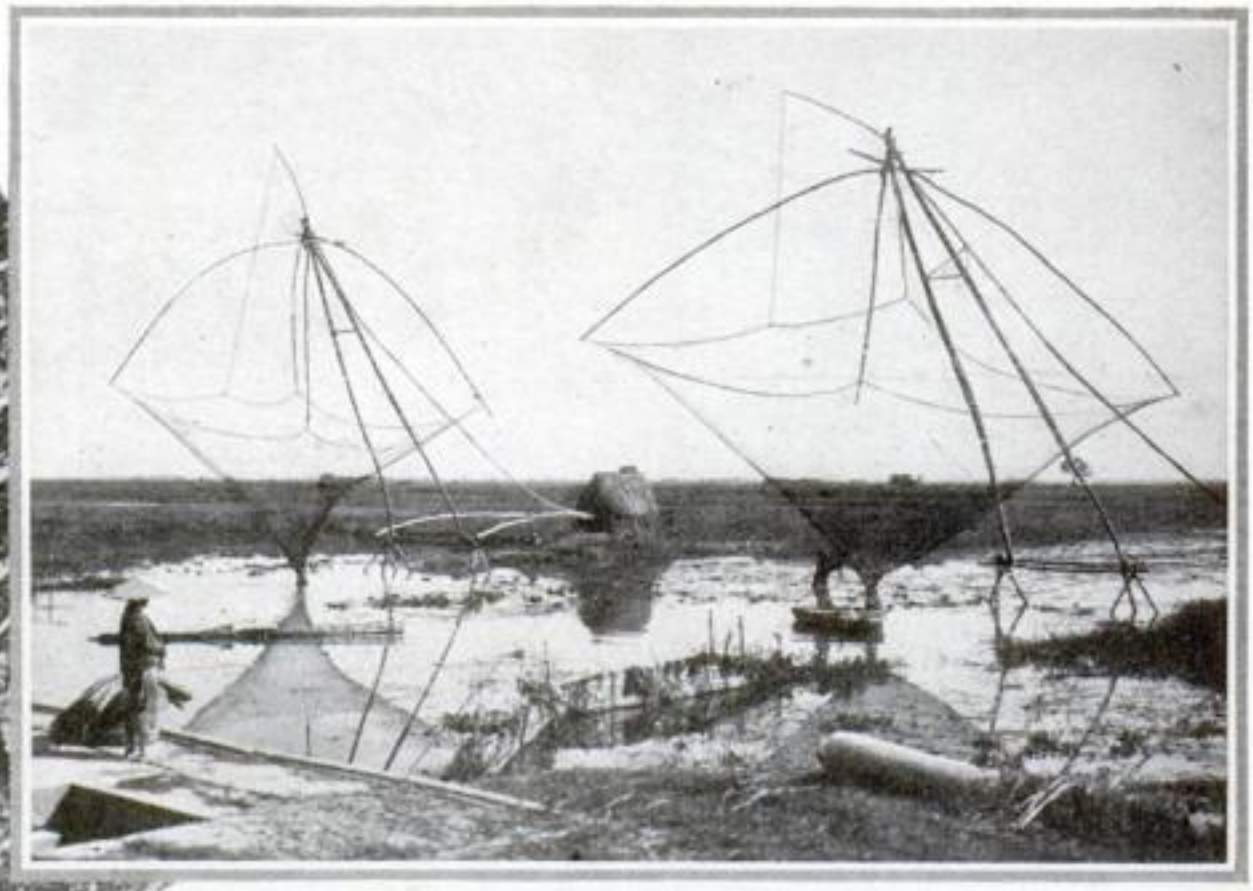
Picture a jagged fragment of rock, more likely irregular than round, about the size of Mount Washington, New Hampshire, and you will have a good mental image of 1932-HA, Dr. Whipple told POPULAR SCIENCE MONTHLY. Its surface, evidently rough since it reflects light but poorly, probably is covered with great masses of crags. A human being visiting 1932-HA would find no air to breathe, and violent extremes of temperature would alternately scorch and freeze him. Even if he could surmount these difficulties, he must move with the greatest caution. So weak is 1932-HA's force of gravity, Dr. Whipple points out, that if this imaginary visitor were to take a strong leap, he would bound clear off the planetoid, never to return!

Our sky neighbor travels in a great ellipse 280 million miles long, requiring a little more than twenty-one months to complete the round trip, Dr. Whipple's calculations show. The journey takes it within 63,000,000 miles of the sun — nearer even than Venus. In some years it goes by the earth more closely than in others. Last May it passed us at a distance of seven million miles, but under favorable circumstances it might approach within two and a half million miles—the distance the earth travels in three days in its journey around the sun.

Along the outer rim of its orbit, 1932-HA visits the region filled with the previously discovered planetoids, or asteroids, as they are sometimes called. More than a thousand are known, ranging in diameter from a few to several hundred miles, but virtually all travel in a well-defined cluster between the orbits of Mars and Jupiter. Only a few, such as Eros, cross the Martian boundary line. The new planetoid is the first of its family known to pass within the earth's orbit, and its discovery brings the center of astronomical interest back to our doorstep just when most new discoveries of heavenly wonders were being made at remote regions of the universe.

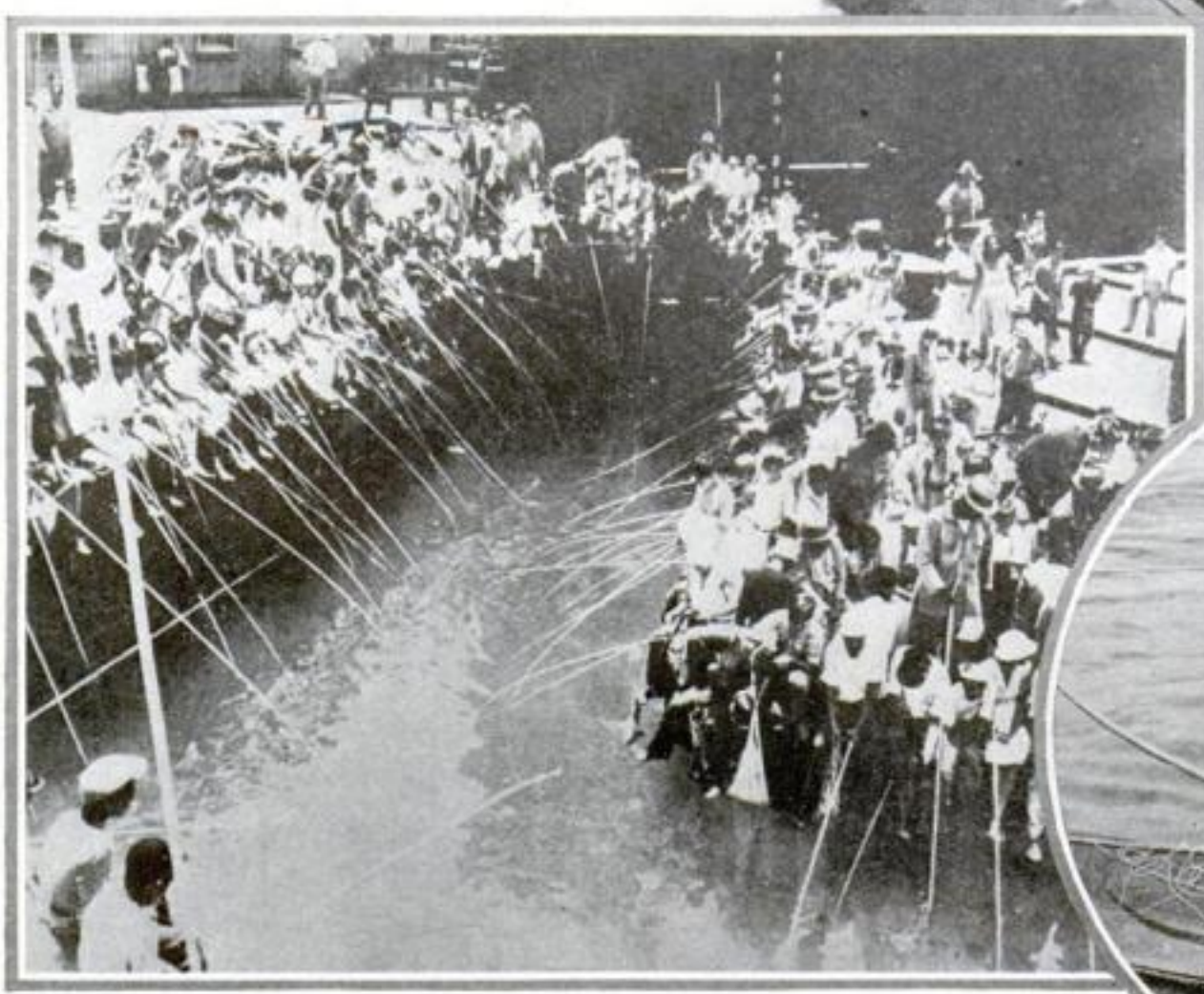
More Ways Than One

Even the manner of catching fish differs from one nation to another, and strange methods have been developed in far-off corners of the world. The pictures on this and the following page show eleven different ways of taking fish and constitute a rare pictorial history of this fascinating art. Above is a native fisherman in the Barbados, West Indies, all ready to set his fish trap that is camouflaged with seaweed. The trap is set each evening



These are not radio aerials but the remarkable dip nets used by native fishermen in French Indo-China. The nets are rigged on long bamboo poles

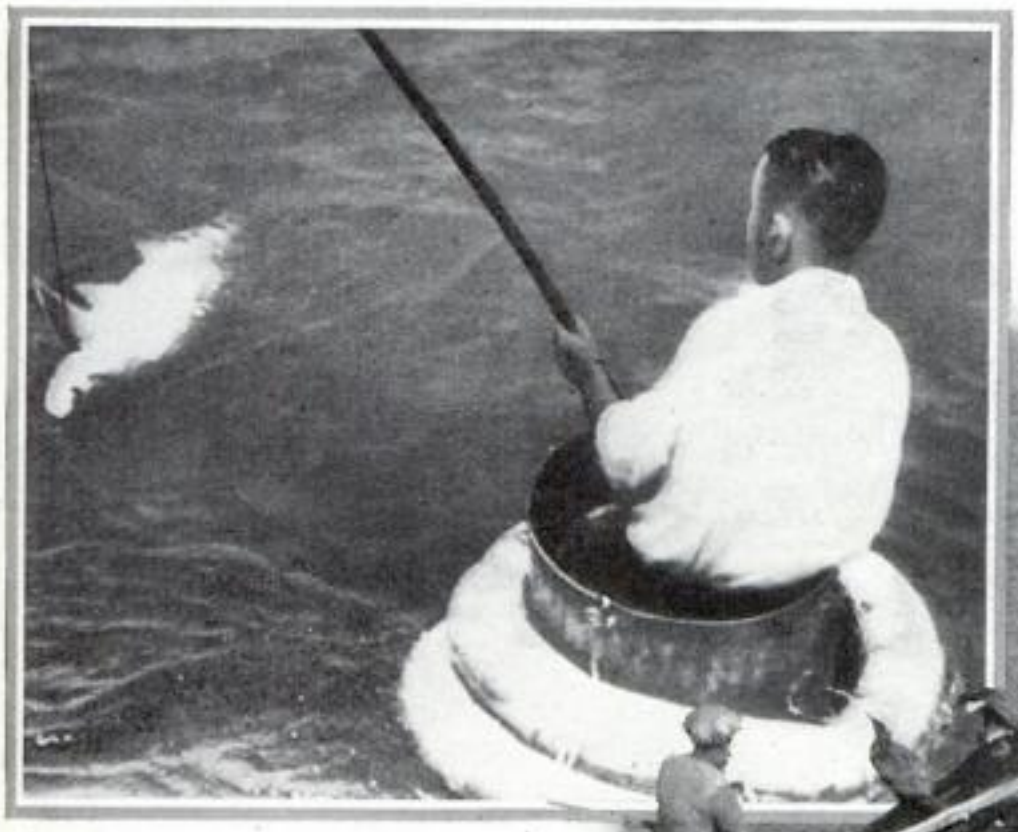
Salmon is the principal catch on the Fraser River, Canada. Below is a fisherman with his net by means of which the salmon are scooped out of the rapids of the river and hauled on board



There was excitement in Honolulu when a large school of halalu was driven by a storm into the shallows of the water front. For three days the fish remained in the sheltered waters, and during that time there were bites for everybody

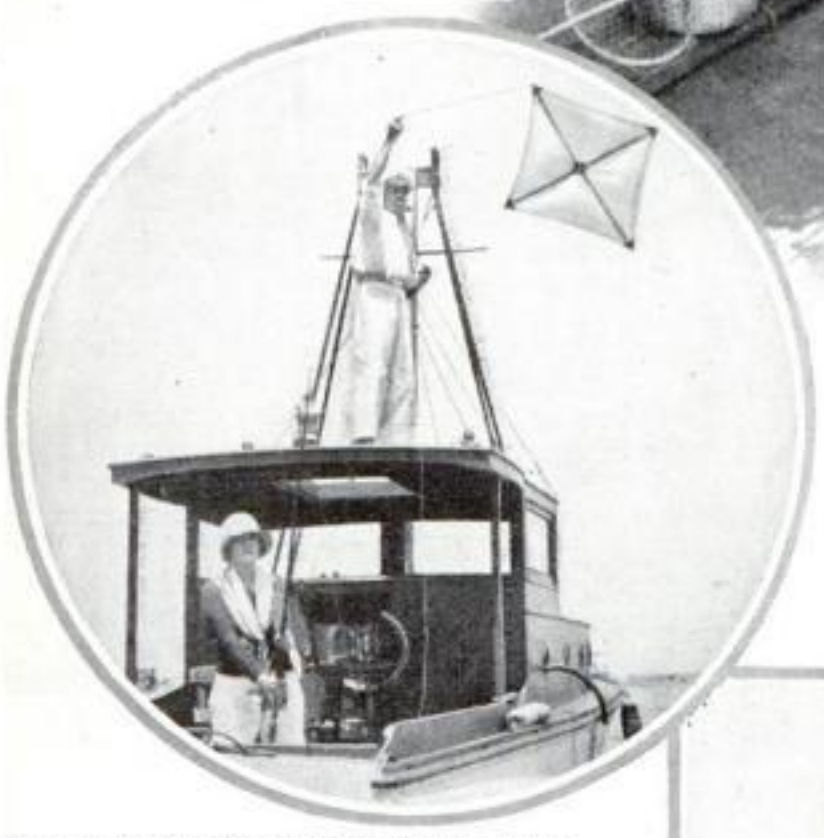
Primitive but exciting is the method of catching fish illustrated at the right. From a forty-pound Eskimo kayak, fish are shot with a bow and arrow. An expert can kill a fish five feet under water

to Catch a Fish



In a garbage can floated with two inner tubes, Bert C. Cohn of Sarasota, Fla., went after tarpon and landed a 111-pound specimen

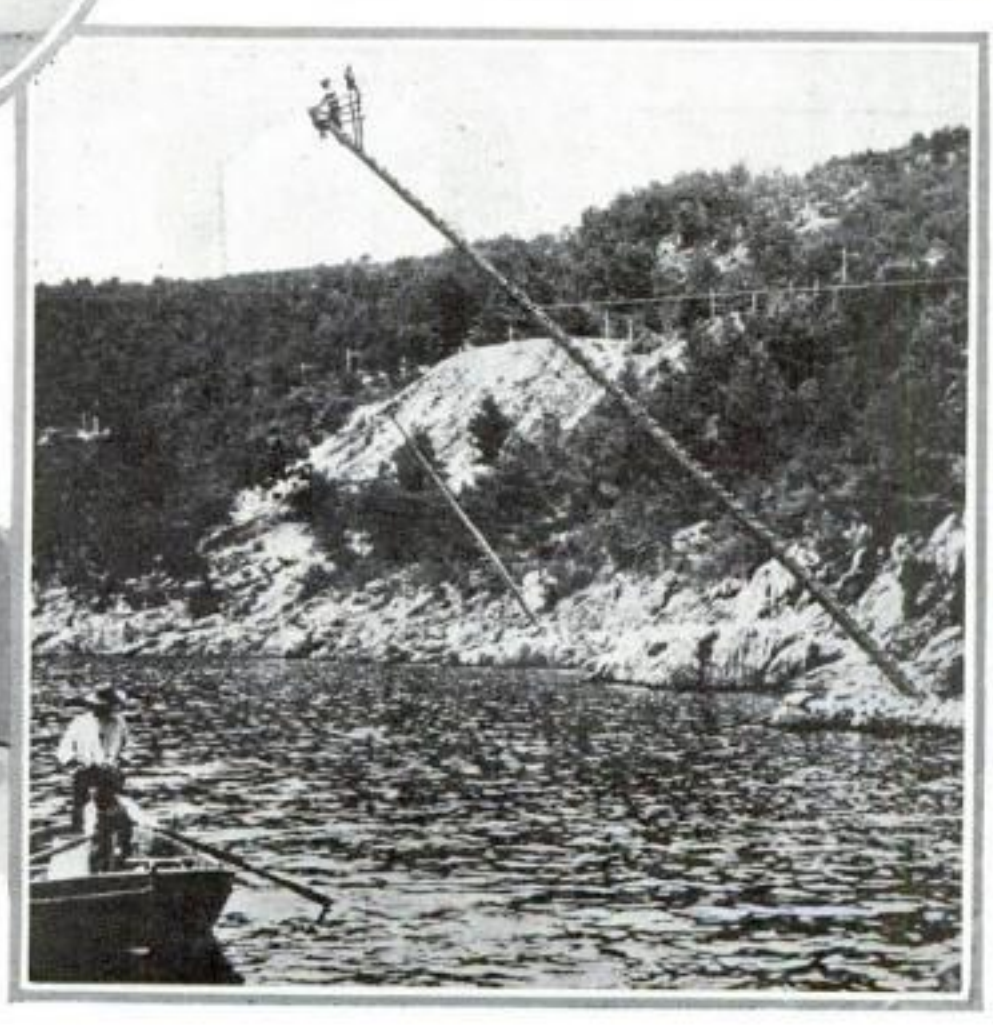
Feathered servants play a part in the lives of Chinese fishermen in Foochow. The cormorants catch all the fish but they can't eat them



Bait attached to the kite bobs over the water and swordfish are lured to their destruction

Revolving nets, rigged to a paddle wheel, are used on the Copper River to catch the valuable salmon. As the wheel turns in the swift current, the big fish, entangled in the mesh, are swung clear of the water. The natives then dump them in fish boxes and later haul them ashore

In Hawaii, spear fishermen peer through a glass-bottomed box in their search for catch



Clinging to the top of a high pole, Mediterranean fishermen scan the blue waters of the big sea for the precious tunny, which is generally found in schools. At a signal from the lookout, the net is lowered and when full is slowly drawn in. With lances and knives the fish are killed and then hoisted from net to boat

WHERE SNOWSLIDES ARE BORN

Dog teams hitched to sledges hauled Prof. Paulcke's instruments and supplies to his observatory in the Alps where he studied the secret history of big avalanches

NEW STUDY IN ALPS SEEKS WAY TO END

Menace *of*

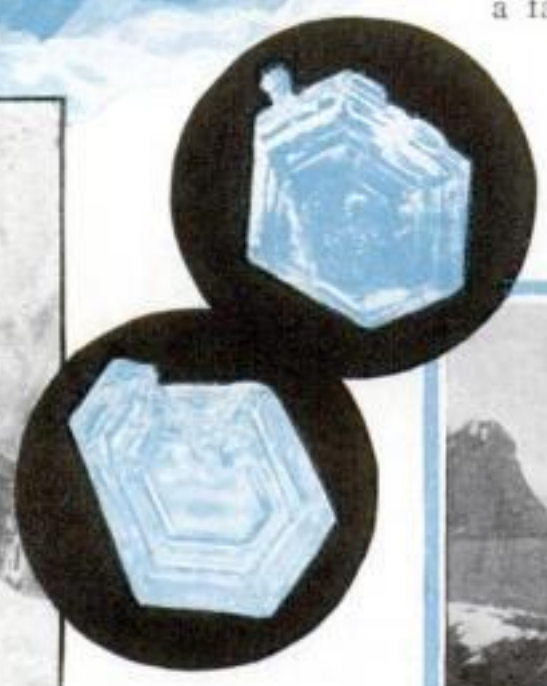
With his microscope, Paulcke investigated the form and nature of snow crystals to learn exactly how snowslides are formed

AVALANCHES were made to order, the other day, in the Swiss Alps. Cameramen recorded their path of destruction in slow-motion pictures during a remarkable series of tests conducted by Prof. W. Paulcke of the University of Karlsruhe, Germany. His experiments revealed the true causes of snowslides, and suggested ways to reduce their terrific toll of life and property.

In the first scientific attempt ever made to tame the slides, which cost the lives of eighty to a hundred persons in the Alps each year, Prof. Paulcke established an observatory high on the famous Jungfrau peak. Here he discovered that a year's snowfall accumulates in a many-tiered mass like a layer cake. The "icing," water from sun-melted snow, seeps down from the surface and runs along between the layers, a fact confirmed by sprinkling bright-colored aniline dyes on the surface and tracing the telltale streaks through the drifts. This seeping water makes it easy for the top layer to slip off completely, just as that of a cake may do if the icing is plentiful.

By undermining blocks of snow with trenches and then slicing them off with a wire rope, Prof. Paulcke

Here is the observatory hut erected high on the Jungfrau peak as the base of operations during Paulcke's investigation of snowslides



Above, two typical snow crystals, a study of which may enable science to predict snowslides. At right, sawing loose a mass of snow to start an avalanche downhill

Unusual Pictures Show Avalanches Made to Order in Test by German Scientist

The dark streaks seen in this snow were caused by colored dyes spread upon the snow and carried by water to various strata. This seepage water is said to be one of the main causes of snowslides

The daring cameraman, right, is taking a picture of a man-made avalanche as it roars down the mountain. In this way movie films were made to determine the speed at which the avalanche travels

Snowslides

Thirty thousand cubic yards of snow and ice in the man-made snowslide, right, starting down the mountain in one of Prof. Paulcke's tests

and his four assistants produced the spectacular phenomenon of artificial avalanches. Placing suitable barriers in their paths, he learned to divert the roaring slides and save theoretical villages from destruction.

The experimenters dressed dummies to represent human figures and placed them in the way of the man-made snowslides to test means of rescue. From experience gained in this way, Prof. Paulcke is perfecting a drill-like probe that will reveal the presence of a buried person by catching in his clothes.

A 3,000-foot movie film brought back by Prof. Paulcke will be used to train mountaineers. It shows graphically how much time an endangered person has to save himself from an avalanche.

In circle, a dummy is placed in the path of an artificial snowslide to study rescue methods. At left of circle, the avalanche is breaking loose; and at left, it is just reaching the dummy which, below, is about to be buried by the snow

Below, the surface of the snow sprinkled with dye to trace seepage water

Fearless Riders turn MOTOR

By Robert

Giving the engine too much gas, the machine literally leaped from under this rider and they both take a tumble

SIX motorcycle engines slowed down to idling speed. The riders, seeking adventure on a warm Sunday afternoon, had collected into a little group near the bottom of a steep hill, not a paved slope but one of dirt and gravel and not a particularly smooth surface.

"It looks steeper than I thought," one of them said.

"That's because that junk pile of yours would balk at a dance floor," another remarked.

"Let's see *you* go up," a third chimed in. "You were the one who suggested this stunt."

"All right. Here goes."

The speaker, who unknowingly was helping along a new sport that for rip-roaring excitement surpasses almost everything else, opened his throttle, bent low over the handlebars as his machine leaped forward, and dashed up the hill amid a shower of dirt and stones.

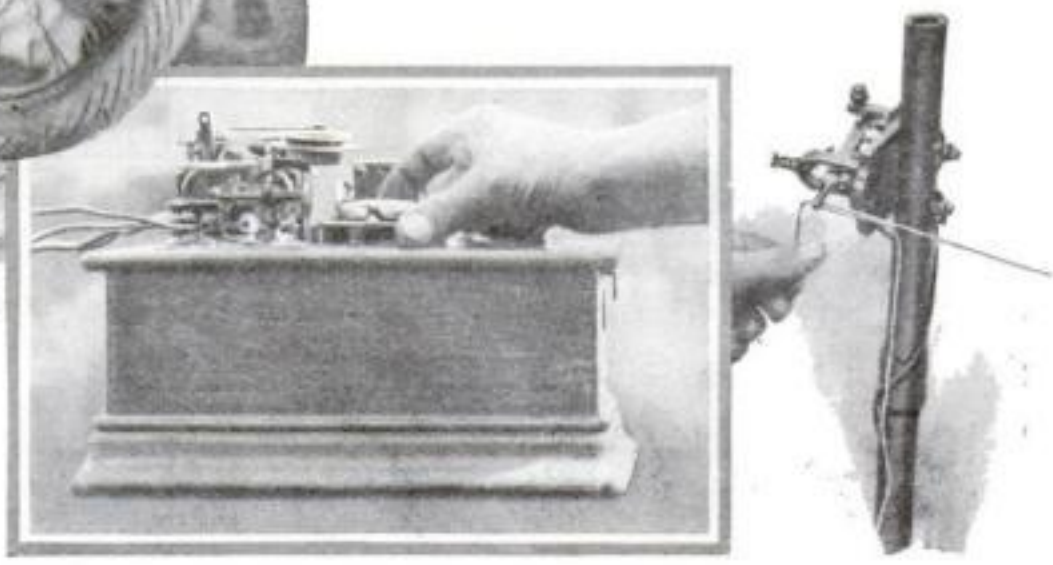
It doesn't matter a great deal whether he reached the top or not. He probably failed, because his machine was built for overland travel, and not for mountain climbing. But he and his fellow motorcycle fans, by staging an informal hill-climbing contest that afternoon years ago, were doing something that now enjoys the position of a major sport in many communities, drawing crowds of 10,000 or more spectators.

In the early days of motorcycling, the puny engines fitted to the bicycle-like machines had so little power that a more than ordinarily steep grade on a regular highway furnished a strenuous test.

Since then have been developed special motorcycles, efficient engines, high-powered fuels, special rider technique, and a brand of dare-deviltry that, to the uninitiated, looks like a fancy attempt at suicide.

Put on your old clothes or a mountain-climbing costume, including shoes that have rough soles, and come along to a typical hill-climb. You could not easily find a more exciting way to spend an afternoon.

Having paid the nominal admission fee that goes towards the expenses incurred in



Here the rider is nearing the top and is determined to go over in spite of the bad bump that has just tossed his front wheel into the air. At right, the electric timer which is started when the contestant's wheel breaks a cord at the foot of the hill and stopped when a second cord is broken at the top. It is accurate to within one tenth of a second

BIKES *into Mountain Goats*

E. Martin

staging the show, you proceed to the scene of the climb. The roar of a motorcycle making a test run across a field quickens your pulse.

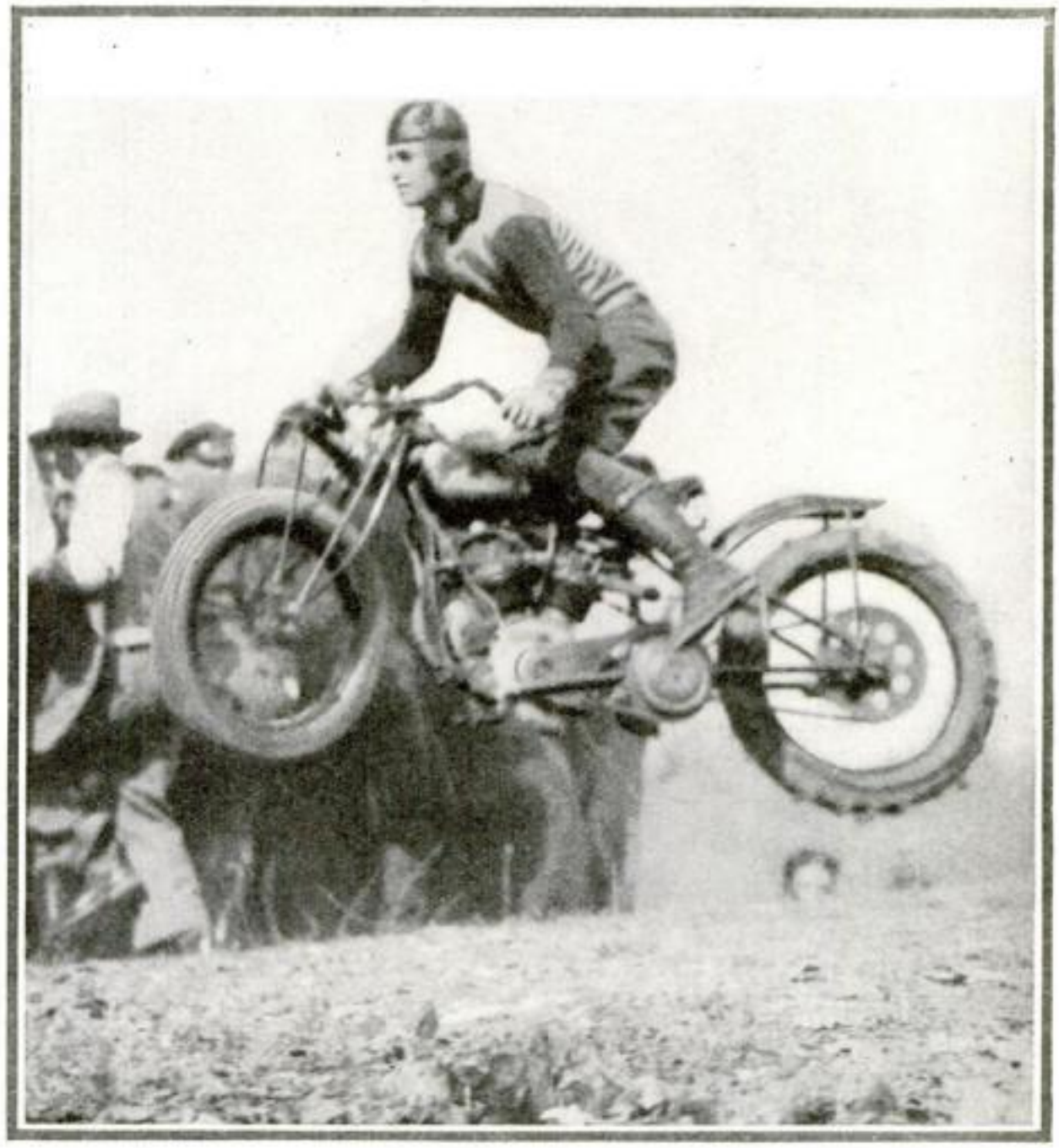
The placards said that the event would take place at one of the most difficult courses in the country. But you had not been prepared to see a hill that looks more like the side of a building. Almost three hundred feet it measures from bottom to top, and it gains more altitude than distance. Half-way up it flattens out a little, as if preparing for the final almost vertical fifty feet.

Motorcycles, many of them carrying girls with gay knickers and wind-tanned faces as passengers, pour in like ants. In the accompanying stream of automobiles are cars with motorcycles strapped on running boards or rear bumpers. These cycles are not like those that roar past the autos. They are the hill-climbing machines, unfit for ordinary road travel because their motors run at too great speed, sometimes as much as 7,000 R. P. M.

By the time the afternoon's first event starts, there are at least 1,000 automobiles and several hundred road-going motorcycles spread over the field below the hill. Some of the visitors and contestants have traveled hundreds of miles to this meet. There are several riders from neighboring states. One came across the continent from Los Angeles. He is Gene Rynne, national champion for 1931 in the forty-five-cubic-inch professional class.

Halfway up the hill a stand has been hurriedly erected, and in it is the electric timer. This star performer of the day chooses to be stubborn and part of the time refuses to work, so occasionally riders have to make the climb all over again. It is because of the temperamental nature of this piece of machinery that a man with a flag stands at the halfway level to stop contestants before they tackle the really difficult part of the course, if the timer goes haywire.

This timer, which, in spite of its occasional weaknesses, is otherwise reliable to the tenth part of a second, consists of an electrically controlled stop watch. A magnifying glass is mounted above the watch



At the top at last! Surmounting the last steep rise, this rider's machine jumped over the hilltop and was snapped while still in the air

The man with the hook is grabbing this machine which has dumped its rider, who is seen scrambling to get out of the way of the falling bike. Left, note thong on rider's wrist. When he is thrown, this thong closes switch and stops the engine

Getting a machine downhill is almost as thrilling as making the climb. At the steepest part it is lowered at the end of a rope but is ridden rest of the way. Right, machine near cord at hill's top

to make reading easier. When a cyclist starts his mad dash up the hill, he breaks a cord that has been stretched across the course ten feet in front of the starting line. This releases a spring that closes an electric contact, starting the stop watch. When, and if, he reaches the top of the hill eight or nine seconds later, his machine breaks a second cord which, operating a similar switch, stops the watch. Need for more accurate timing is bringing into use timers that register 1/100th of a second.

Scoring depends on time and distance. If the course is conquerable—that is, if it is not impossible for cyclists to go over the top—time alone is the deciding factor. If rain or steepness or other conditions makes it impossible for any of the contestants in a given class to go over, distance enters into the scoring. Markers on stakes indicate the distance in feet from the starting point.

It is almost time for things to start happening. A man clinging to a rope appears at the top of the hill and is eased down the steep part of the course for fifteen or twenty feet. At the end of the rope is a large iron hook. You wonder what he is going to do. For the present he does nothing except dangle. You will have to wait until someone tries to ride up the hill.

A sputtering of more regularity and intensity than the other noises attracts your attention. It comes from the bottom of the hill. The rider who will start the day's thrills is about ready to go. He is speeding up his engine, listening critically to its roar.

His machine is interesting. It has just enough engine, frame, and wheels to be called a motorcycle. Everything not absolutely necessary to performance or reasonable safety has been left off. The mudguards are scanty. There are no speedometers, lights, horns, or other luxuries. The engine emits the strong odor of hot castor oil. In fact the whole motorcycle represents a special form of vehicle developed by manufacturers solely for hill-conquering.

The engine is not unlike that in a typical racing motorcycle. It travels at high speed, but is geared down through chain and sprockets so that tremendous pulling power is delivered to the rear wheel. This wheel is equipped with a steel chain so that it can grip the earth; incidentally, this chain proves very efficient for showering spectators with dirt.

The rider slips a looped leather thong over his left wrist, and tucks the other end between two spring clips mounted near the left handlebar grip. This thong is a safety device. When the rider is thrown his wrist jerks the leather from between the clips, allowing them to close and ground the ignition so that his engine stops.

The track is cleared, the man with the hook clings to the hillside at one side of the course, and the announcer megaphones the name of the contestant.

With a roar the motorcycle leaps forward, leaving a skyrocketlike trail of dirt and sand behind. The first timing line snaps, an instant later the machine and rider leap a foot into the air as they clear the bump that marks the beginning of the leveled-out section of the hill. More flying of dirt, and the whipping machine tackles the real hill.

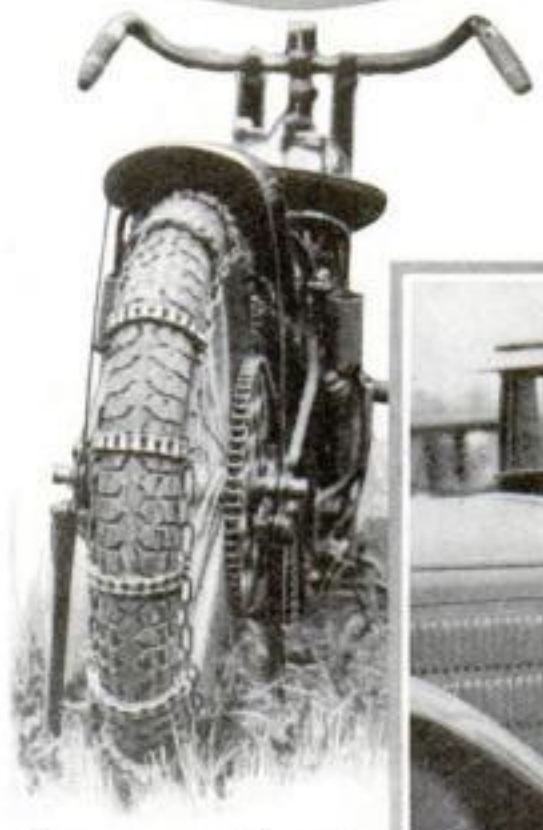
Almost at the top! Then in another instant the motorcycle is standing on its tail while the rider goes sailing through the air towards the sidelines. Evidently he has given the powerful engine a little too much gas, and the machine simply jumped out from under him.

A gasp escapes the crowd as the rider lands clear of his machine, but directly below it. The engine is sputtering to a stop, and the cycle lands with a crash after its backward somersault. The man with the hook is in action, having recovered his balance after leaping out of the way.

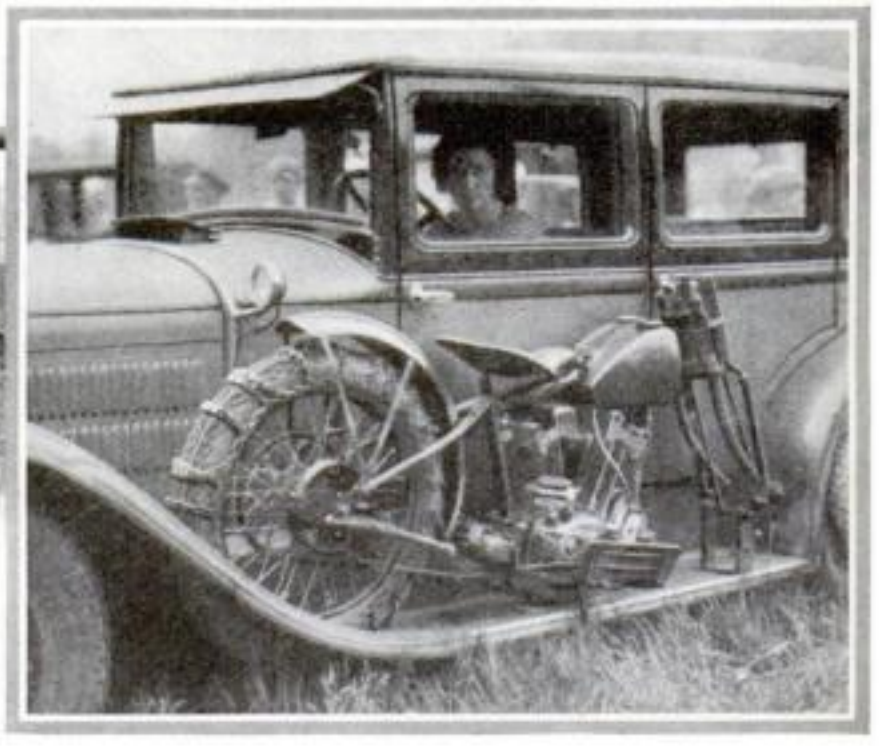
"More slack," he yells, and goes scrambling down the embankment. With a frantic lurch he snares the front wheel of the motorcycle with the hook. It holds, and the machine is prevented from sliding down the bank on top of the rider.

Now comes another difficult part of the attempt to conquer the hill. While assistants at the top of the hill pay out the rope that has been snubbed about a tree, the hookman and rider ease the machine down the steepest part of the grade to the level section. Then the rider mounts the machine, the hook is disengaged, and he travels to the starting point in a ride almost as thrilling as that in the opposite direction.

His motor- (Continued on page 109)



Bikes come to the meet on the fenders of cars, as they are unfit for road use. Above, note the heavy tire chains that give traction



Have YOU an *Invention* FOR SALE?

This inventor started out on his own to sell his patented hot dog cooker and he is now making a good living out of it

By Edward Thomas

A YOUNG Chicago engineer some months ago was thrown out of work because of slack times in his industry. One day, while on a job hunt, he stopped for a cheap lunch at a hot dog stand. The frankfurter he got was overdone and greasy. It had been languishing on the grill at least half an hour. This gave him an idea. The moment he reached home, he set to work on a quick cooker that would serve each customer with a freshly broiled sausage. He constructed a simple apparatus that did the trick in forty seconds flat.

The inventor filed a patent application on his little device, and offered it to several manufacturers. None would have it. Meanwhile, the landlord, the butcher, and the baker were camping on his doorstep with overdue bills. The hard-pressed engineer decided to take a chance. He borrowed some money from a friend, made a few dozen of the cookers himself, loaded them in his car, and started out to sell them to owners of roadside stands. He got rid of twenty the first day. The last time I heard of him, he was going up and down the country peddling his invention, and making a good living at it.

Failure to find soap to wash with led to discovery that earned this man a fortune

I tell this story because it so clearly demonstrates one way of solving a problem that every inventor faces—that of selling his invention. Not everybody is in a position to adopt the Chicago man's method. Dynamos and steam engines, for example, cannot be hawked along the highway. But there are more ways than one to kill a cat, and at least as many to dispose of an invention. And sell his invention the inventor must, if it is to do him or the world at large any good.

Mechanical ingenuity produces great inventions, but it seldom produces wealth for the inventor. To get that, salesmanship is needed. A striking instance of clever marketing came to my notice a few years ago. A New Yorker invented a new circuit for radio receiving sets and immediately applied for a patent. In those days, the radio craze was at its height. The inventor knew that the Patent Office was jammed with radio inventions. Fearing that the fad might wane and his invention prove commercially worthless before his patent was issued, he at once took steps to cash in on his idea. This is how he did it:

Calling on a score of manufacturers, he proposed to each that he lend him one of his sets long enough to take out certain parts, substitute others, and prove his contention that the set, with these changes, would sound as well or better than before. and be from $2 to $10 cheaper to make. Most of the manufacturers agreed to this plan, and in the end the inventor licensed his invention to a number of them, receiving a royalty on every set sold. By the time his patent was granted, he had profited handsomely from his invention.

This case not only shows ingenuity in salesmanship; it also illustrates several other points every inventor should keep in mind. First, the inventor lost no time in applying for a patent. Second, he did not wait for his patent to be issued before trying to sell his invention. Third, his experience demonstrated that manufacturers will buy an invention when they are shown that it will save or make money for them. Fourth, he found that all of his prospective buyers were honest. Since he had to display his invention and explain what parts he substituted to lower manufacturing cost, the men he approached had plenty of chance to steal his ideas.

In the vast majority of cases, manufacturers may be trusted. I have practiced patent law for more than twenty years, and the instances of dishonesty of this type I have observed in that time can be counted on the fingers of one hand.

Many inventors stand in their own light because they are too suspicious. Not long ago, I had some dealings with such an inventor. He was a young drug store clerk, who had compounded a new, relatively harmless disinfectant, a stainless salt containing silver, that would make an admirable substitute for highly poisonous bichloride of mercury mixtures now used for the same purpose.

The chemist was in bad health, and so poor he could not pay the expenses of filing a patent application. As I believed in the merits of his discovery, and trusted some manufacturer could be found willing to back it financially, I interested several firms in it. One manufacturer seemed ready to buy it and advance the cash needed to get a patent. But, naturally, he insisted on seeing a sample of the stuff.

This the inventor refused to prepare, though he repeatedly told me it would take only half an hour to do so. Several times, in the office, he promised me to make up a sample. But by the time he reached home, his fears again had got the better of him and he telephoned me, saying he had changed his mind and that I should be able to put through the deal without a specimen. Of course, I could do nothing for him. Today, he still is as poor as he was when first he came to see me.

Instances of dishonesty, though rare, sometimes occur. In Washington, D. C., they tell the story of an inventor who devised an apparatus for measuring electrically the thickness of paper. It occurred to him that his invention might prove useful to the rubber industry in measuring the thickness of sheets used in manufacturing inner tubes. He took his description and drawings to a large rubber plant and had

a conference with one of the engineers.

After they had talked for a while, the engineer, so the story goes, asked the inventor to excuse him for a few minutes, as he had another previous appointment at that moment. The inventor was ushered into an adjoining room, and told to wait there. Suddenly, something seemed to tell the inventor that all was not well. He boldly walked back into the conference room, where he found the engineer and another man poring over his papers and making notes. In a flash, he realized that, had the engineer wished to confer legitimately with an associate on the invention, there would have been no need for lying. He quickly gathered up his belongings and left the plant.

To guard against exceptional cases of this kind, the inventor, in submitting descriptions and drawings, should see that there is nothing on the papers to show when the application was filed or what opinion the Patent Office has expressed as to the novelty of the invention. This will prevent a dishonest prospective buyer from claiming that he previously filed an application on a similar device.

The percentage of inventors who lose the benefits of their work through theft of their ideas is extremely small. Many more fail to profit from their inventions because of their own negligence. The most common mistake is failure to file a proper patent application as soon as the invention has been completed. Invariably, this should be done before negotiations leading to a sale are begun.

This is why: An application may, in possible future disputes, serve as proof that the man holding it was the first, or real, inventor of the device. For that reason, most manufacturers refuse to deal with an inventor who has not applied for a patent.

As soon as his application is filed, the inventor should begin trying to sell his invention. Several considerations make this desirable. First of all, the need for a particular device may have ceased to exist by the time the patent itself is issued. That, you will remember, was one of the reasons which led the inventor of the new radio circuit to sell his invention as quickly as possible.

Then, it sometimes is doubtful whether an invention can be patented at all or, if patentable, whether the patent will stand up after it is issued. Though granted on a useful device, a patent, for legal or technical reasons, eventually may turn out to have little commercial value.

Consider what happened to an inventor who, about a year ago, perfected an ingenious hold-up alarm for use in bank tellers' cages. One part of his device was a carpet with a double lining of wire mesh, which was connected with an alarm system. The other part was a metal needle to be attached to the heel of the teller's shoe so that, in case of a hold-up, he could, by twisting his foot, puncture the carpet, the needle bridging the gap between the two layers of wire, closing an electrical circuit and thus setting off the alarm.

The inventor had filed a patent application and took his apparatus to a manufacturer, who offered to buy it outright for $5,000. Believing he could make a fortune in royalties once he obtained his patent, the inventor, without consulting his patent attorney, turned down the offer. Later his lawyer told him he had made a mistake, and advised him to correct it, if possible. The patent, he explained, might never be issued or, if it were, might prove of scant value. He based this opinion on the fact that a similar hold-up alarm, operated through bars at the height of the teller's knees, recently had been put upon the market. The inventor, however, refused to reconsider his decision. Since then, he has not been able to interest anyone else in his invention. He probably never will.

Six Rules for INVENTORS

Who Want to Make Money

1. Have a search made of previous patents. It may save untold trouble, expense, and disappointment.

2. File a patent application as soon as work on the invention is finished. This will facilitate finding a buyer for your device.

3. Start trying to sell your invention immediately after filing your patent application, and use all your ingenuity in marketing your work.

4. Don't be suspicious of possible purchasers; the majority of people in this world are honest.

5. Take proper precautions to protect yourself against exceptional cases of dishonesty. Don't let your descriptions show the date of patent application.

6. Be willing and ready to modify your invention to make it commercially profitable, or change the purpose for which it was devised.

The inventor walked back into the conference room and found the engineer and another man poring over his papers and making notes

In this connection, let me emphasize the importance of having a search made of previous patents, even before an application is filed. This often prevents unnecessary expense and much needless effort and heartbreak.

Some years ago, a chemist invented a process of delivering carbon dioxide into the air surrounding plants, in order to speed their growth and produce better and larger crops. All plants absorb carbon dioxide, a compound of carbon and oxygen, from the atmosphere. With the aid of sunlight, they convert the carbon into sugars and starches, releasing the oxygen. The inventor's idea, in brief, was to extract carbon dioxide from factory smoke after soot and other impurities had been removed, pipe it to the crops, and bathe them in it.

He applied for a patent and was turned down. Refusing to take no for an answer, he spent thousands of dollars in making appeals. The case dragged through court after court until finally, in 1929, the Court of Appeals ruled the invention was unpatentable because it had been anticipated by others. It developed that, over a period of twenty years, inventors had been ahead of him in every detail of his invention. One old German patent even described a process for producing carbon dioxide by purifying blast-furnace gases, and an account was unearthed of experiments in which carbon dioxide had been delivered to growing plants through tubes with openings at the depth of their roots. When the final decision was handed down, the chemist was penniless and disillusioned. From ten to twenty-five dollars spent for a search would have saved him his money and years of work and trouble.

The fact that an invention may have been anticipated, or that, for other causes, a patent never may be granted, is not the only reason for trying to market an invention as soon as the application is filed. One obvious incentive is that, in the time elapsing between filing the application and obtaining the patent—sometimes years—a great deal of money may be made.

That was the experience of the inventor of the new circuit for radio sets, and also of a man who invented a necktie with an elastic lining, which is claimed to make the tie more resilient than others. After applying for a patent in 1921, he immediately placed his product on the market and engaged in a vigorous advertising campaign. Here are the records in his case: In 1922, his sales totaled $400,000; in 1923, $890,000; in 1924, $1,400,000; in 1925, $2,000,000, and in 1926, $2,500,000. He had made more than half a million dollars by the beginning of 1923, when his patent was issued. As a patent is good only for a limited number of years, an invention's money-making life, so to speak, can be lengthened by cashing in on it before the patent becomes effective.

There are other reasons, aside from earning money, that make it desirable to put an invention on the market as quickly as possible and push its sale to the utmost. The commercial success of an invention often bears considerable weight with the Patent *(Continued on page 103)*

CASH PRIZE WINNERS

In Heroes of Science CONTEST

Here Are the Names of Twenty-nine Whose Skill Brought Them Success in May

ANOTHER happy group of contest enthusiasts has joined the "Twenty-Niners Club," as we call the winners in the POPULAR SCIENCE MONTHLY Heroes of Science Picture Cut-Out Contest. The names of the twenty-nine who receive $1,000 in cash for their admirable efforts in the May monthly contest, in prizes ranging from $500 to $10, appear on this page. Last month (P. S. M., July '32, p. 31) we announced the April winners.

The "Twenty-Niners Club" now numbers eighty-seven members who, thus far, have won a total of $3,000 in cash prizes. Plenty of others still have the same opportunity to join the "Club," whether they have tried previously for a prize or not. The July contest does not close until July 31. The August competition is now open and will run until August 31.

In addition, everybody, everywhere, is invited to participate in the Grand Prize Contest, in which seventy-one cash prizes, totaling $4,000 and ranging from $2,000 to $10, will be awarded. To compete for these cash awards it is not necessary to have entered the monthly contests. You need not be an expert in any field to take part. All details of the Grand Prize Contest will be found on page 32 and 33.

FIRST PRIZE . . $500

M. Coupland, ***Dallas, Texas***

SECOND PRIZE $100

W. O. Hodges
San Angelo, Texas

THIRD PRIZE $50

John Mercer
White Castle, La.

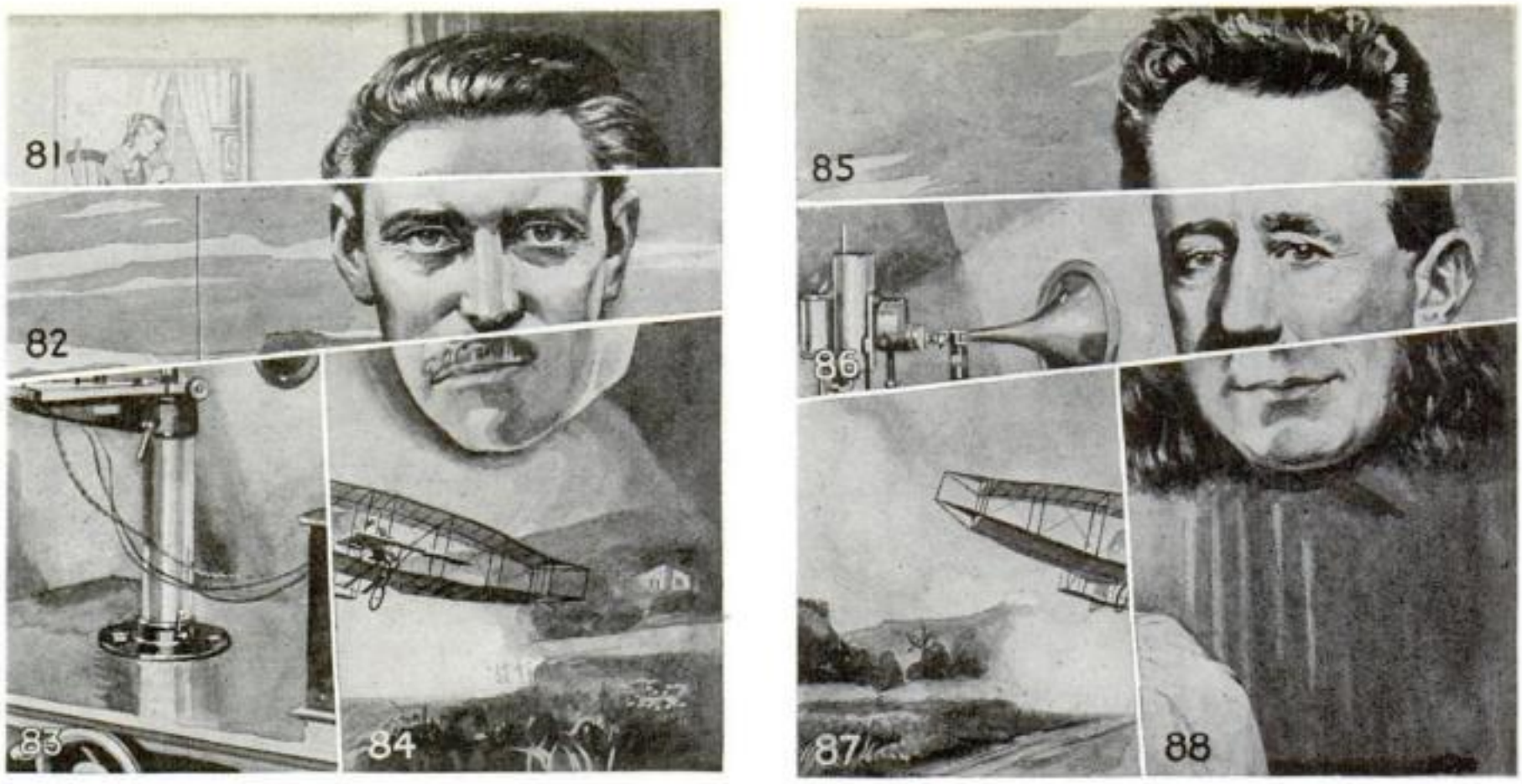
SIX $25 PRIZES

Frank Derro, *West Allis, Wis.*
Paul Kovacsik, *Akron, Ohio*
Jack Mac-Brair, *Brooklyn, N. Y.*
Walter Quest, *Nashville, Tenn.*
G. S. Seal, *San Francisco, Calif.*
Edward P. Smith, *Chattanooga, Tenn.*

TWENTY $10 PRIZES

Trygue Aageson, *Milwaukee, Wis.*
John Alto, *Grand Rapids, Mich.*
Fred Beaumont, *New Bedford, Mass.*
Albert E. Cooper, *Phila., Pa.*
Morton Crane, *Floral Park, N. Y.*
Mrs. John Cutler, *Claremont, Mont.*
Gerald Damush, *Brooklyn, N. Y.*
H. Vergil Dechert, *Peoria, Ill.*
Charles Delmont, *New York City*
J. Ralph Fenton, *New Castle, Pa.*
George Guerry, *New York City*
Margaret Howell, *Clarendon, Va.*
W. Normal Krell, *Fort Worth, Texas*
Ethel Millspaugh, *Anderson, Ind.*
Charles North, *New York City*
Sue D. Runyon, *Millington, N. J.*
Van Dee Sickler, *Los Angeles, Calif.*
Mrs. Lydia Ward, *El Paso, Texas*
Paul J. Welzel, *Puyallup, Wash.*
A. W. Woehr, *Lakewood, N. J.*

¶ *YOU May Win a Prize by Entering at Once Our Big Picture Cutting Contest* . . . SEE TWO FOLLOWING PAGES



Cut out these pictures along the white lines and you will find it easy to put eight parts together to make two

$10,000 *in* CASH

Here Are Last Two Heroes of Science

OUR great Heroes of Science Cut-Out Puzzle Picture Contest, which began in the March issue, now enters its last month. To the winners of this final monthly contest, POPULAR SCIENCE MONTHLY again will award $1,000 in twenty-nine cash prizes, ranging from $500 to $10. The names of the fortunate twenty-nine who captured the prizes in the May contest will be found on page 31.

If you failed to take part in this fascinating game during the five preceding months, you still have a chance to win one of our generous cash awards, for this last monthly contest is a distinct and separate competition. If you have tried without success so far, be sure to make a last attempt—you may win in the home stretch! Besides, the contest for our seventy-one Grand Prizes, totaling $4,000 and ranging from $2,000 to $10, will now be staged.

For those who are new to the game, let us explain once more how it is played. The trick is simple; young and old can do it as long as they are alert, and no expert training or experience in any field is required to win. At the top of these pages, you will note four composite pictures representing Heroes of Science and Their Accomplishments. As you see, each of these pictures is divided into four parts, making sixteen parts in all. Each of the parts belongs in a different picture. Begin by cutting all of them out. If you reassemble them correctly, eight of the sixteen cut-outs will give you TWO COMPLETE PICTURES of Heroes of Science, with eight parts left over.

Prizes in this final monthly contest will be awarded to those who submit the two correct complete pictures, assemble and mount them in the neatest and most skillful manner, and state the names and accomplishments of each of the two Heroes of Science in twenty words or less.

In competing for the monthly prizes, submit only TWO COMPLETE PICTURES, in which no left-over cuttings are used. These two complete pictures should be assembled from the cuttings numbered from 81 to 96 inclusive.

Now for the Grand Prize Contest! In each of the six monthly contests only eight of the pictures' sixteen parts were used. That leaves forty-eight unused cuttings, which careful contestants have preserved to participate in the Grand Prize Contest.

THESE forty-eight left-over cuttings, when assembled correctly, will give you TWELVE ADDITIONAL COMPLETE PICTURES of Heroes of Science and Their Accomplishments. Our generous Grand Prizes will be awarded to those contestants who submit the twelve correct additional pictures, assemble and mount them in the neatest and most skillful manner, and state the name and accomplishment of each of the twelve in twenty words or less. To be considered for the Grand Prizes, the twelve additional solutions must be mailed or delivered to the offices of POPULAR SCIENCE MONTHLY not later than September 30, 1932.

To compete in this final monthly contest or the Grand Prize Contest, it is not necessary to be a regular reader or subscriber of POPULAR SCIENCE MONTHLY. Nor do you need to buy the magazine. You may borrow copies from a friend or consult them at the public library or at any office of POPULAR SCIENCE MONTHLY and copy or trace the pictures. You may have any friend, neighbor, or relative assist you in solving the puzzles.

So far, this has been the most successful contest ever staged by POPULAR SCIENCE MONTHLY. We hope you will compete for the Grand Prizes—and may the best men win! Before you start work on this month's puzzle pictures or the twelve additional ones, be sure to read carefully the rules of the contest on the opposite page.

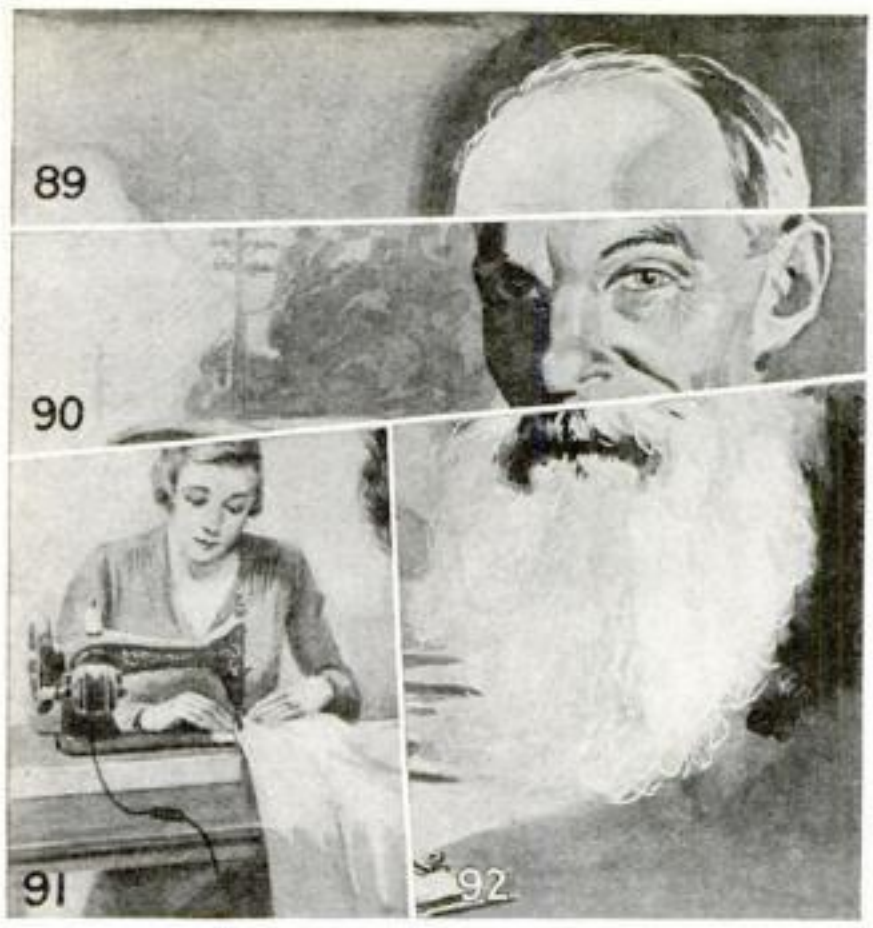
MONTHLY PRIZES

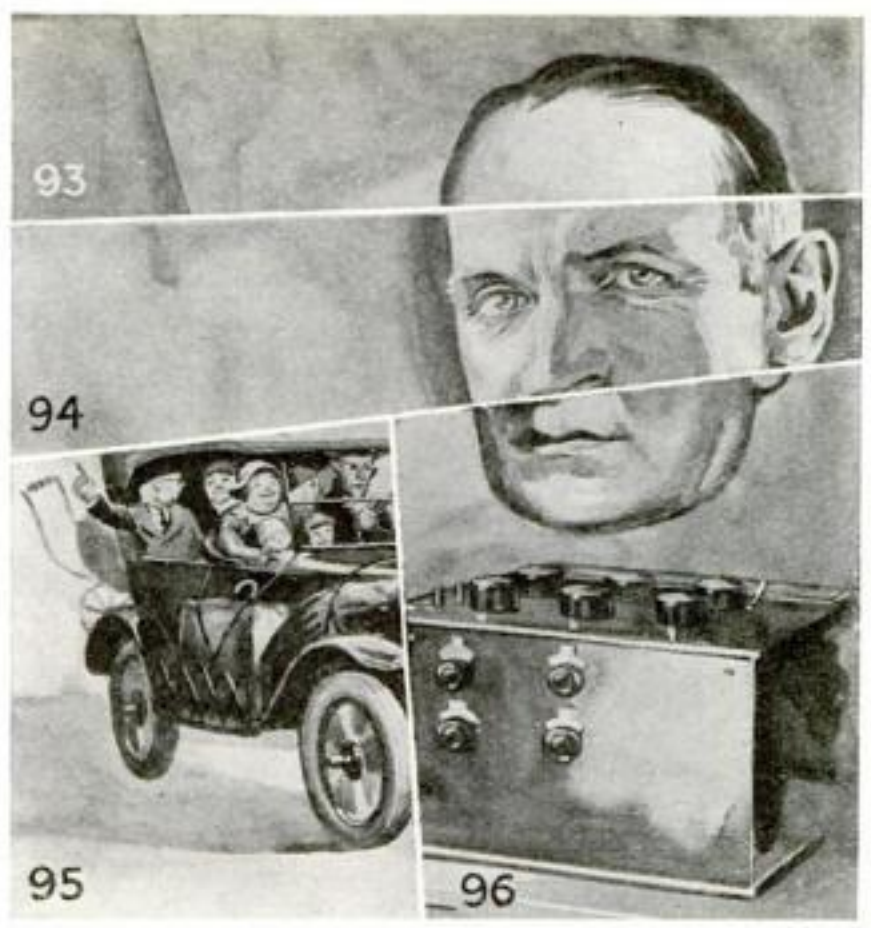
First Prize	$ 500
Second Prize	100
Third Prize	50
Six Prizes, $25 Each ..	150
Twenty Prizes, $10 Each	200
Total	$1,000

GRAND PRIZES

First Prize	$2,000
Second Prize	500
Third Prize	200
Three Prizes, $100 Each	300
Five Prizes, $50 Each .	250
Ten Prizes, $25 Each ..	250
Fifty Prizes, $10 Each .	500
Total	$4,000

Turn to Page 31 for Names of Winners in the May Contest





pictures. Eight parts will be left over. Save these carefully to use in making pictures for the Grand Prize Contest

PRIZES FOR SOLVING NEW AND EASY PICTURE PUZZLES

Henry Ford, pioneer in mass production of low-priced autos

Morse; artist, inventor, developer of electric telegraphy

Byrd, explorer of a new continent in the wild Antarctic zone

Curtiss, second only to the Wrights as a builder of aircraft

Elias Howe, famous American inventor of sewing machine

Marconi, world famous developer of life-saving wireless

The Men Whose Pictures Can Be Completed Are in Above Group

Rules of This Contest... Read Carefully

1. Each month for six months, beginning with March, POPULAR SCIENCE MONTHLY has printed four composite pictures of Heroes of Science and Their Accomplishments. Each set of pictures, when cut apart and assembled correctly, will make two complete pictures with eight parts left over.

2. The pictures must be pasted together. The monthly prizes will be awarded to those contestants who assemble the pictures correctly and in the neatest and most skillful manner. Each of the two complete pictures must be accompanied by twenty words or less, identifying the Hero of Science and his accomplishment.

3. Answers to each monthly contest must be mailed or delivered to the offices of POPULAR SCIENCE MONTHLY not later than the last day of the month following the date of publication of the magazine in which the pictures appear. Thus, solutions of the puzzle in this month's issue must be mailed or delivered not later than August 31.

4. At the close of the six monthly contests, there will be a final contest for Grand Prizes. To compete for these, contestants must carefully save the cuttings left over from the monthly contests. These left-over cuttings, during the six months, will produce twelve additional complete pictures of Heroes of Science and Their Accomplishments, if assembled in the correct way. These additional pictures must not be submitted during the progress of the monthly contests, but at their close. Entries for the Grand Prize contest must be mailed or delivered at the offices of POPULAR SCIENCE MONTHLY not later than the thirtieth of September. The officials of the Popular Science Institute, who award the prizes in the six monthly contests, also will act as judges in the Grand Prize Contest. Their final decision will be announced as soon as possible.

5. To receive consideration for the Grand Prizes, contestants must submit not less than twelve additional complete pictures.

6. Grand Prizes will be awarded to those contestants who assemble the twelve additional pictures correctly and put them together in the neatest and most skillful manner. Each of the twelve pictures must be accompanied by twenty words or less, identifying the Hero of Science and his accomplishment.

7. In case of ties each tying contestant will be awarded the prize tied for. This rule will be observed in the monthly contests as well as in the Grand Prize contest.

8. All entries should be addressed to the Heroes of Science Contest Editor, POPULAR SCIENCE MONTHLY, 381 Fourth Avenue, New York City. Name and address of the cntrant must be written plainly on each page of the entry. Entries with insufficient postage will not be accepted. The publishers cannot be responsible for delay, loss, or non-delivery of entries. No contribution entered in this contest will be acknowledged, and none will be returned. No letters of inquiry regarding points covered in the rules can be answered.

9. There is no entry fee. You need not buy POPULAR SCIENCE MONTHLY to compete. You can borrow a copy from a friend and trace or copy the pictures, or you can examine a copy of the magazine at any office of POPULAR SCIENCE MONTHLY or at the public libraries free of charge.

10. Each contest is open to everybody, everywhere, except employes of POPULAR SCIENCE MONTHLY and the Popular Science Institute and their families. The officials of the Popular Science Institute will act as judges and their decision will be final.

On the tropical water of South America, above, scientists from this country search the forests for new and rare trees that will grow when brought to the United States. At left, Guatemala native with a quantity of avocados, a fruit now growing in Florida

Treasure Hunters Comb Earth for Priceless Plants

Dr. David Fairchild, in charge of plant exploring for the Department of Agriculture, inspecting mangosteens, a fruit from Java

By WALTER E. BURTON

WHENEVER you eat an avocado, a mangosteen, bamboo sprout, or bread made from durum wheat; enjoy choice steak or pork chops from cattle or hogs fed on alfalfa and soy beans; or marvel at the beauty of an Oriental lily, you are reaping the benefit of work done by a handful of explorers who devote their lives to the search for new and valuable plants that will grow in the United States.

Only recently, exotic plants and fruits from the islands of the Caribbean were brought to Washington by these strange treasure hunters. Sixteen cases of potted growing plants and a large quantity of seeds preserved in cold storage were landed at the Government wharf and inspected, classified and fumigated.

To secure these specimens, trails were cut into jungles and tropical swamps were invaded. Whole trees were cut down and huge burdens borne out on the shoulders of men. Thus seventy-two palms, 106 fruit and nut trees, and 333 ornamental plants were carried from the wilderness and brought to America. Here they will be tested, developed, civilized, and no one can say what their future value may be.

This is but one small instance of the work done by the Plant Introduction Division of the Department of Agriculture. No spot on earth is too remote or too inaccessible for the men of this division to invade. Into the jungles of Central America and Africa, the deserts of Mongolia, fruit markets of the Orient, and the back yards of foreign cities they go to gather seeds, scions, and living plants. Their work is fascinating, romantic, adventurous, and sometimes dangerous. It has long periods when no outstanding discovery is made. Then one trip may yield a useful crop like the soy bean which will pay for the next thousand years of exploring.

On the other hand it may be that an American product will save a distant land from famine. This is what happened recently as the result of work done by Dr. Charles F. Swingle, a plant explorer who in 1929 carried into the arid regions of Madagascar the drought-resistant tepary bean from Arizona. The handful of seeds Swingle gave the natives grew readily and this year over 6,000 pounds of the beans were planted and their rich yield is expected to take the place of the prickly pear, practically destroyed by the cochineal insect. Thus by exchange does America pay its debts and plants travel around the world.

THIS wandering of plants with the help of man has been going on for many centuries. When your ancestors generations back got tired of the berries, fruits and roots in their territories, they would invade the neighboring country in order to bring back something better and more to their liking. Such plant introduction probably was the very beginning of agriculture. Later, sea captains made a practice of collecting and bringing home strange plants that they found in far-away places. Some vessels had fair-sized green houses in which plants could be preserved alive. But it remained for the United States Department of Agriculture to create the modern agricultural explorer.

Imagine for a moment that you are such an explorer, preparing to set out in quest of new and valuable plants. You are working through the Government Plant Introduction Division located in one of the temporary war buildings in Washington. Your activities, according to a brief outline sketched by B. T. Galloway of the Plant Introduction Division, would be somewhat as follows:

You first call on crop specialists and

This Is the Strange Story of Men Who Meet Adventure in Distant Lands While Seeking New Sources of Food

Dr. Fairchild, seated, and Dr. P. H. Dorsett examining a collection of tropical fruit brought into this country by the plant hunting experts

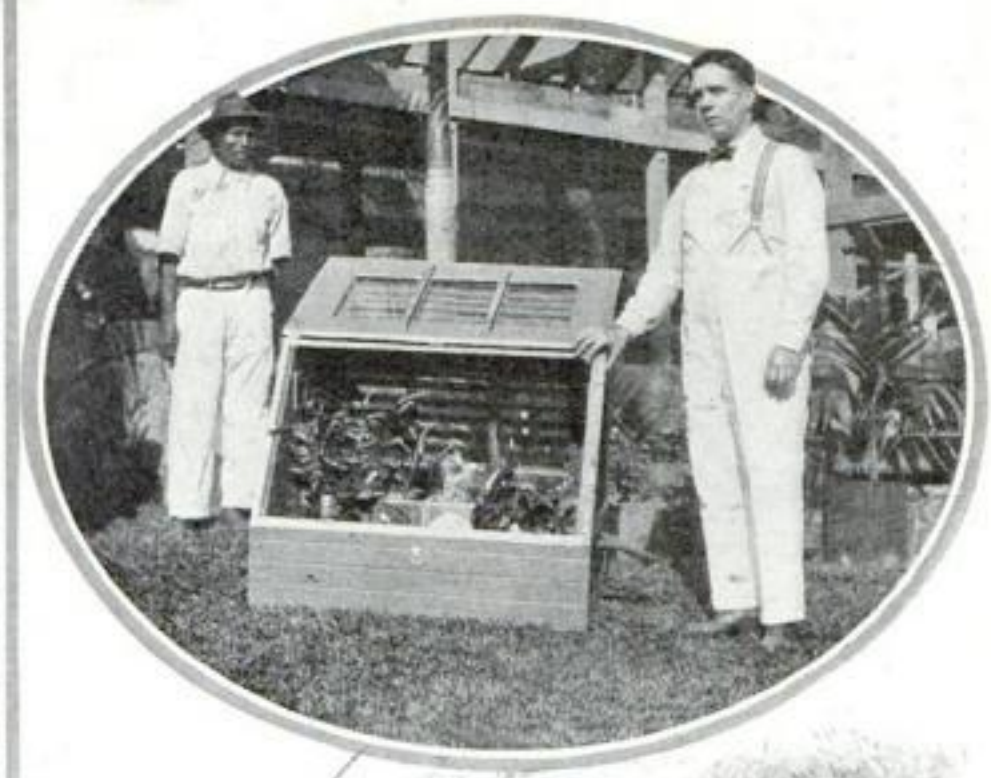
other plant experts of the Department of Agriculture, and learn all that you can from them about the plants you are to seek. Besides visiting experts, you consult books and other published records only to find in many cases that the information they contain is extremely meager and unreliable!

You already have learned all about quarantine laws and regulations, so that you will not unknowingly bring into the country some bug or beetle that might multiply and become a dangerous pest. In your spare time you gather together cameras and film, labels, tags, camping supplies, and collecting equipment; arrange for letters of credit, passports, letters introducing you to foreign scientists who can be of assistance to you.

Of course, you already have trained yourself in agriculture, horticulture, botany, plant geography, and a foreign language or two; and you have learned to pack seeds and plants for shipment so that they will reach the United States alive.

EVENTUALLY you arrive at a remote Chinese village and within a short time you have secured native helpers, assembled a caravan. At last you start on the actual search for, let us say, a blight-resisting pear.

You wander about for weeks, find water sometimes difficult to obtain, get lost, subdue a mutiny among your native helpers, and may be captured by bandits who may decide that the logical thing to do is to shoot you and the other members of your party; but you have little of value that interests bandits, and they release you. At last you find the desired pears, gather all the seeds you can, pack them carefully, and transport them to the nearest town for shipment by camel pack, river boat, ocean liner, and various other channels to the United States.



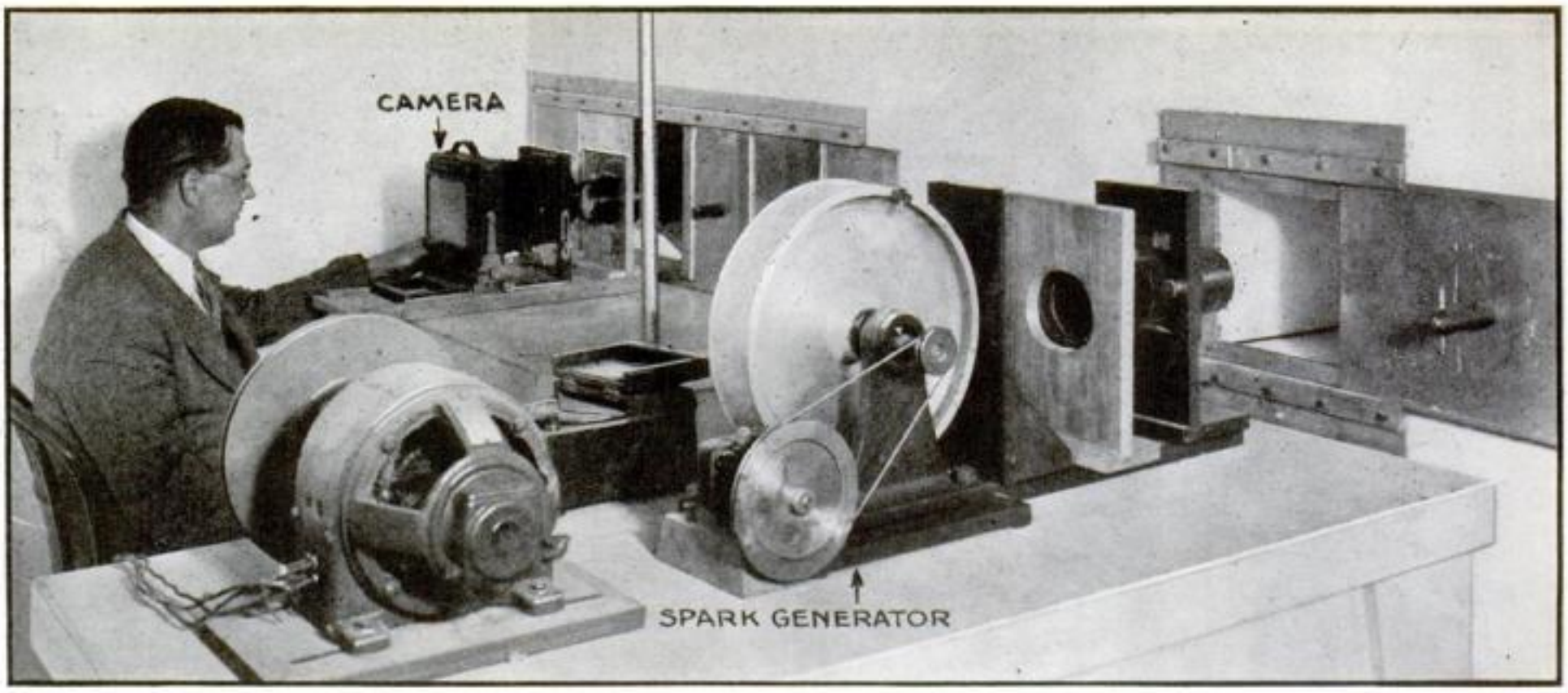
In oval, a greenhouse case in which potted plants are brought to America. Above, F. N. Meyer, pioneer plant explorer, hunting for plants in China

When the Plant Introduction Division receives your seeds and plants, it sends them to experimental gardens and orchards where they are carefully nursed through their period of growth. Some go to universities and to a few qualified private experimenters. In time one or two may find America a favorable country, and flourish, producing fruit or grain superior to anything available before their arrival. Their popularity spreads, and within a few years the handful of tiny seeds that you spent three months in collecting has multiplied into a crop worth many millions each year.

The dean of American plant explorers was just such a man. He was Frank N. Meyer, who spent nine years wandering on foot over China, finally dying in the waters of the Yangste River. He was partly or wholly responsible for introducing such valuable plants as the soy bean, various peaches, pears, centipede grass, jujube trees, chestnuts, and elms. He walked 10,000 miles from Turkestan to the East Coast of China, poking about in odd corners, ever on the watch for something new in the way of growing things.

W. J. Morse, of the Department of Agriculture, inspects black miso—fermented ground soy beans. It comes from Japan and is used in soup

In 1905 Meyer started the Chinese persimmon on its road to popularity in America. It has yet to "arrive" in a big way, but it is one of the most promising of naturalized plant citizens. The persimmon that he got from the Ming Tombs district in China aroused a new interest in this type of fruit, and plant hunters ever since have been keeping their eyes open for something even better. They seem to have seen it in the Fuyu persimmon, a variety that does not pucker your mouth when you eat it. You *(Continued on page 112)*



With this apparatus, a schlieren photograph of an object in an adjoining room is being made at the U. S. Bureau of Mines

Camera Reveals Secrets of Fire

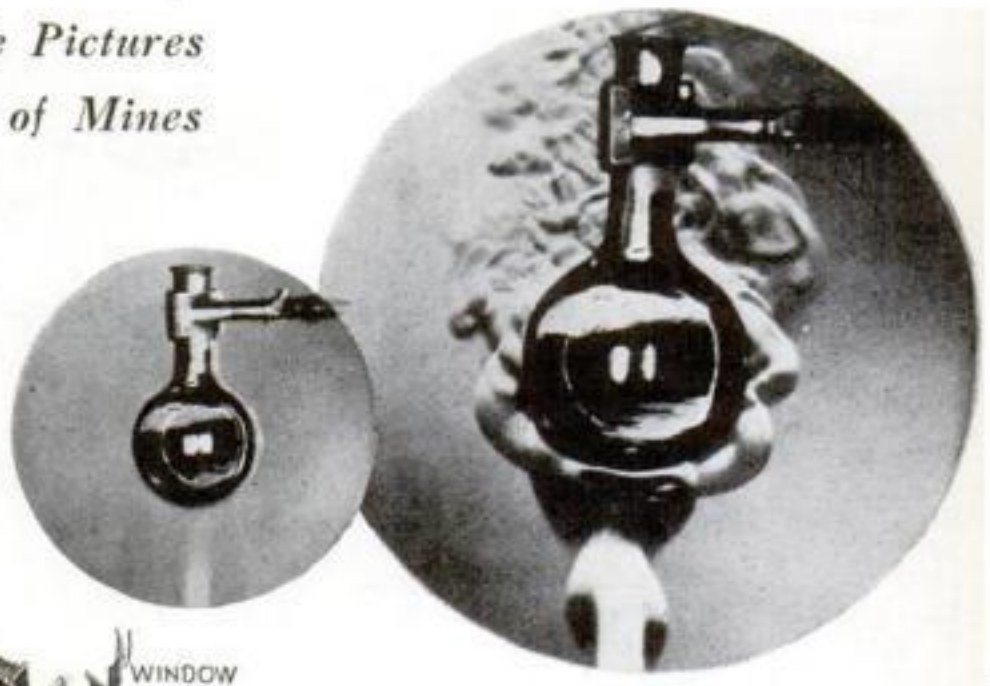
Invisible Gases Seen in Remarkable Pictures of Flames Taken in U. S. Bureau of Mines

IF YOU could put on a pair of magic spectacles that would give you the power to look at invisible objects, you might see sights like those in the photographs reproduced here. Made recently by experimenters of the U. S. Bureau of Mines through a process called "schlieren photography," they depict for the first time some of the fascinating curiosities of Nature's wonderland.

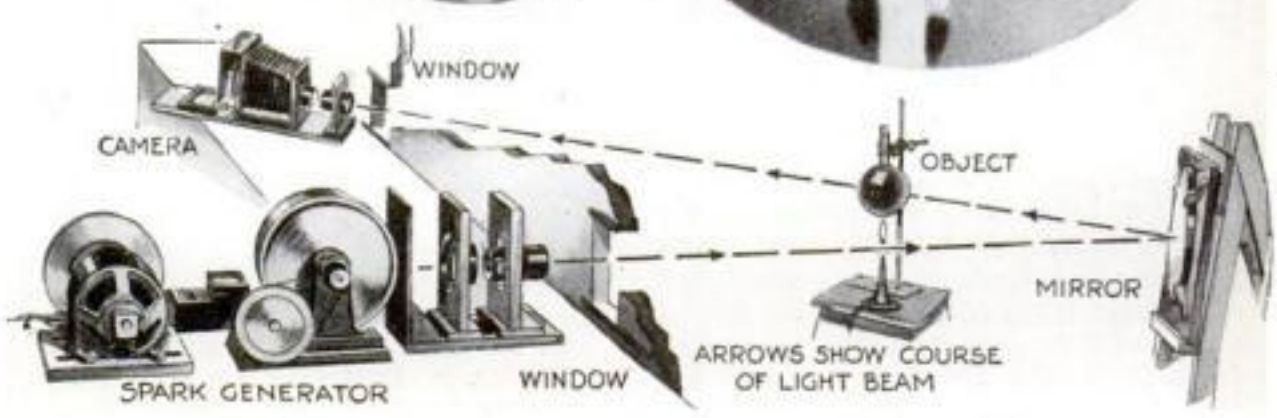
Most persons have only a vague mental image of the way the heat of a gas burner flows against a cookpot and makes the water in it boil, but now the process is vividly shown by the camera. Billows of hot gases from a Bunsen burner swirl like smoke around a flask of water, in one of the Bureau of Mines' photographs.

Hydrogen gas, used to fill balloons, and carbon dioxide gas, a common product of combustion, are pictured flowing from the open ends of pipes into the air. The first is seen rising, while the second sinks—a striking demonstration that hydrogen is lighter, and carbon dioxide heavier, than air. To the naked eye, these streams of gases flowing into the air would be invisible.

Extinguishing fire with electricity, an intriguing new experiment of still unexplored significance, is a third subject for the photographs. Some months ago, Bernard Lewis, physical chemist at the Pittsburgh, Pa., station of the U. S. Bureau of Mines, demonstrated that he could put out small flames by bringing electrified pieces of wire gauze near them (P.S.M., Mar. '31, p. 65). The explanation is believed to be that particles in



In small circle a flask of water is boiling in flame of Bunsen burner and this is all the unaided eye can see. In large circle, schlieren photo shows hot gases enveloping the whole flask



Drawing shows the arrangement of the apparatus used in making a schlieren photograph

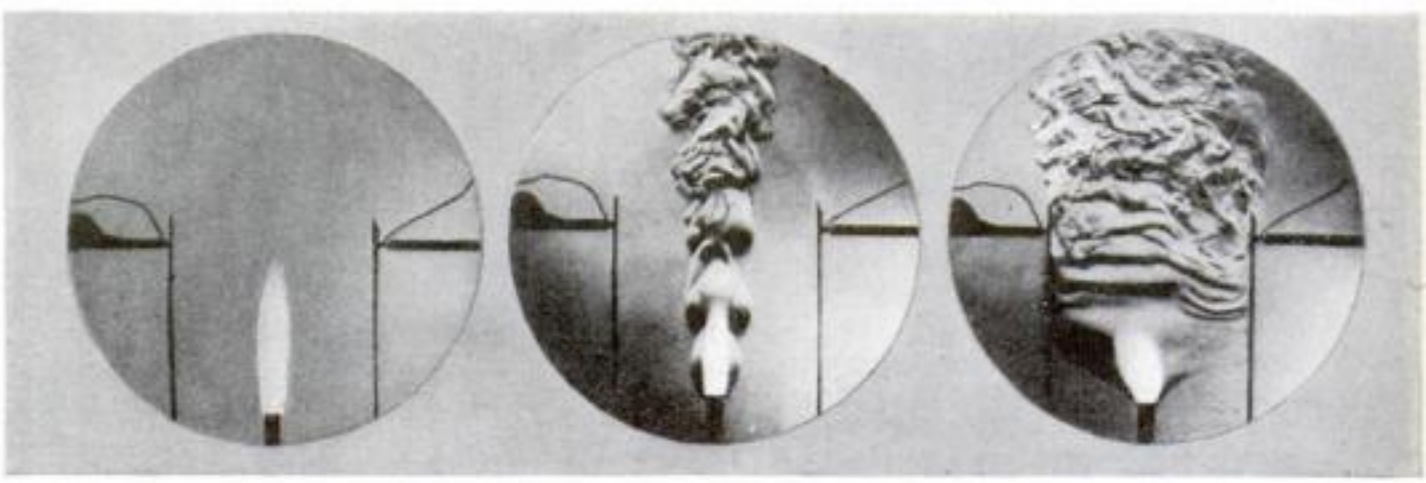
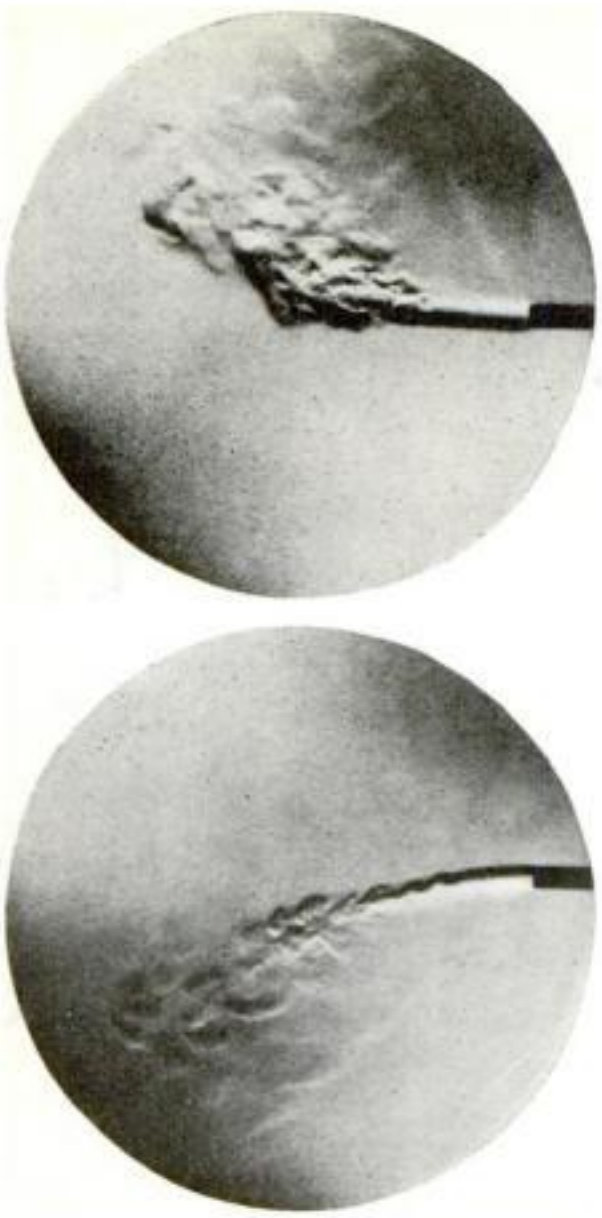


Photo at left shows an ordinary flame as seen by the naked eye, and other views show the same flame pictured by schlieren process. At right, thousands of volts have been applied to plates, pulling the flame to pieces



These pictures are visible proof of the weight of two gases. The upper is a schlieren photo of hydrogen, which is seen rising, and the lower is of carbon dioxide, which sinks in air

a flame are themselves electrically charged, and that electrodes carrying a high voltage will attract the charged particles and literally tear the flame to pieces. This is shown in the schlieren photographs, which reveal a flame pulled sidewards like a stretched garter when thousands of volts of electricity are applied to near-by plates of metal; a smaller flame would have been extinguished.

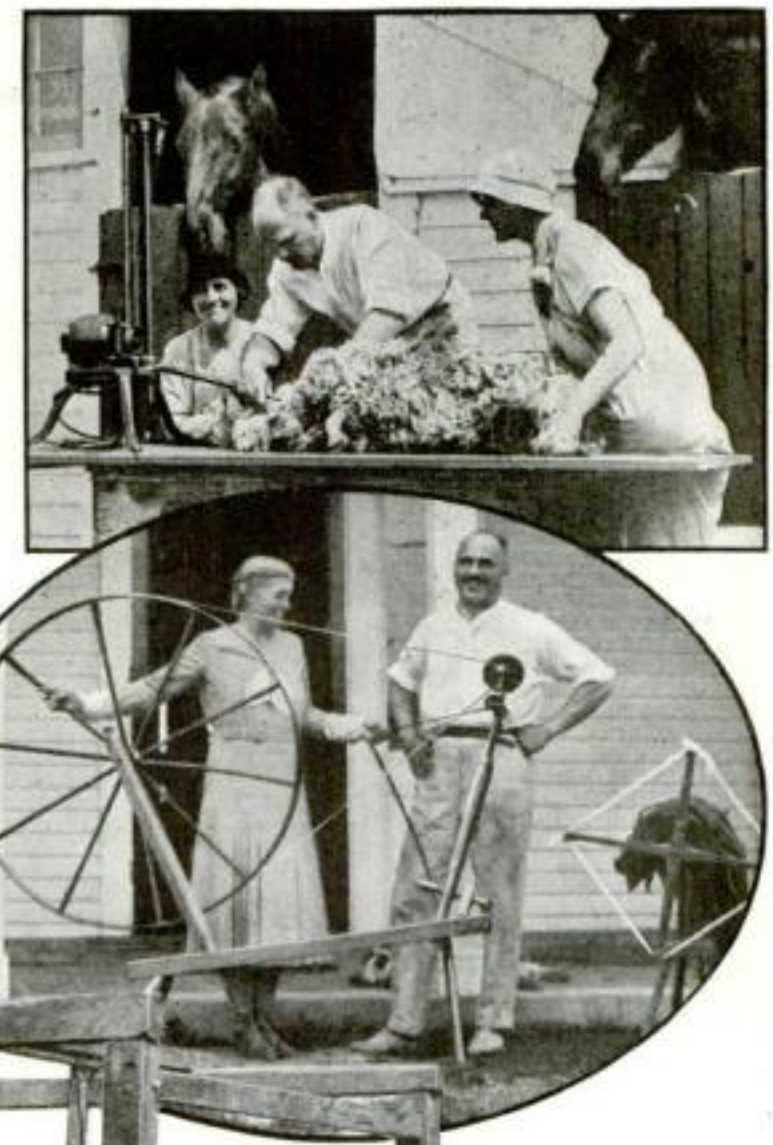
"Schlieren photography" takes its name from a German word that means "streaky" or "nonhomogeneous." When a point of light is created instantaneously, as by an electric spark, and the rays are passed through gas clouds of nonuniform density, they are refracted, or bent, and produce streaks and shadows upon a photograph. This fact, discovered several decades ago, is applied in making schlieren pictures, which have been used hitherto in the study of flying projectiles and explosions. In the Bureau of Mines' apparatus, the electric spark is furnished by a motor-driven electrostatic machine. This light is thrown upon the object to be photographed with the aid of lenses and a mirror, as shown in the diagram on the opposite page. The resulting pictures show phenomena that the human eye cannot see.

CLOTHES TO BAN COLDS

SUITS of clothes made from a new fabric that will banish colds are predicted by Maurice Holland, of the National Research Council. He envisions the fabric as manufactured from cotton in such a way that it will absorb perspiration and regulate body heat perfectly.

MAINE'S GOVERNOR RAISES SHEEP AND WEAVES WOOL INTO CLOTH

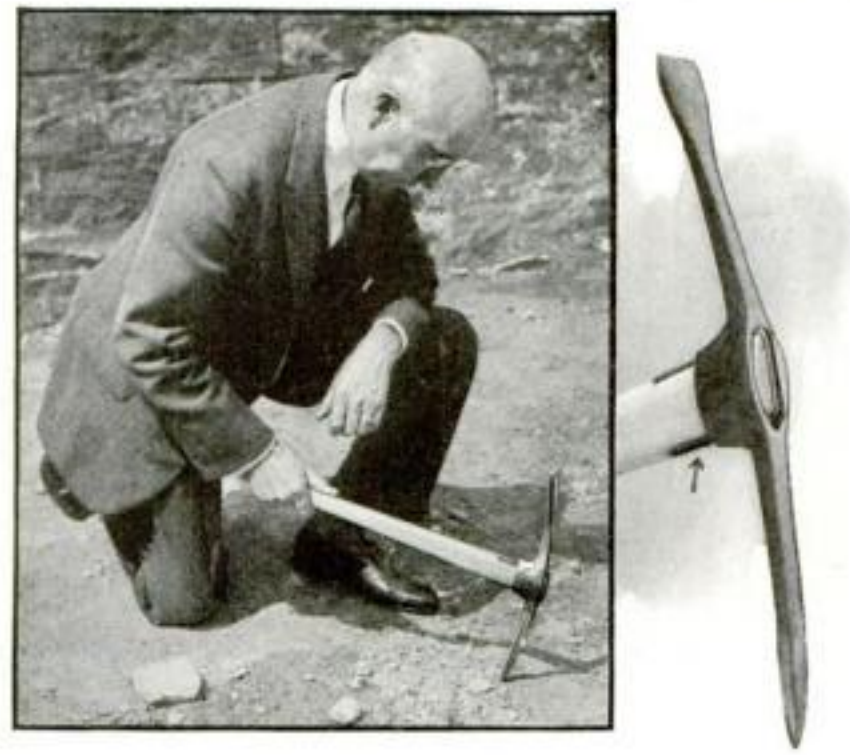
TO UNUSUAL hobbies of well-known men must now be added that of sheep raising. This pastime occupies the spare-time hours of Governor William T. Gardiner of Maine, whose well-equipped farm at Phipps Point, Me., receives his attention as soon as he has disposed of matters of state. Last spring he personally assisted in shearing his sheep. Recently the Governor announced his intention of utilizing some of his home-grown wool in manufacturing his next suit of clothes, using a 200-year-old spinning wheel and loom. The wool, after shearing, will be carded, spun, and woven by methods reminiscent of pioneer days. There will be no question as to whether the finished garments are "all-wool," for Governor Gardiner personally will superintend their manufacture from start to finish.



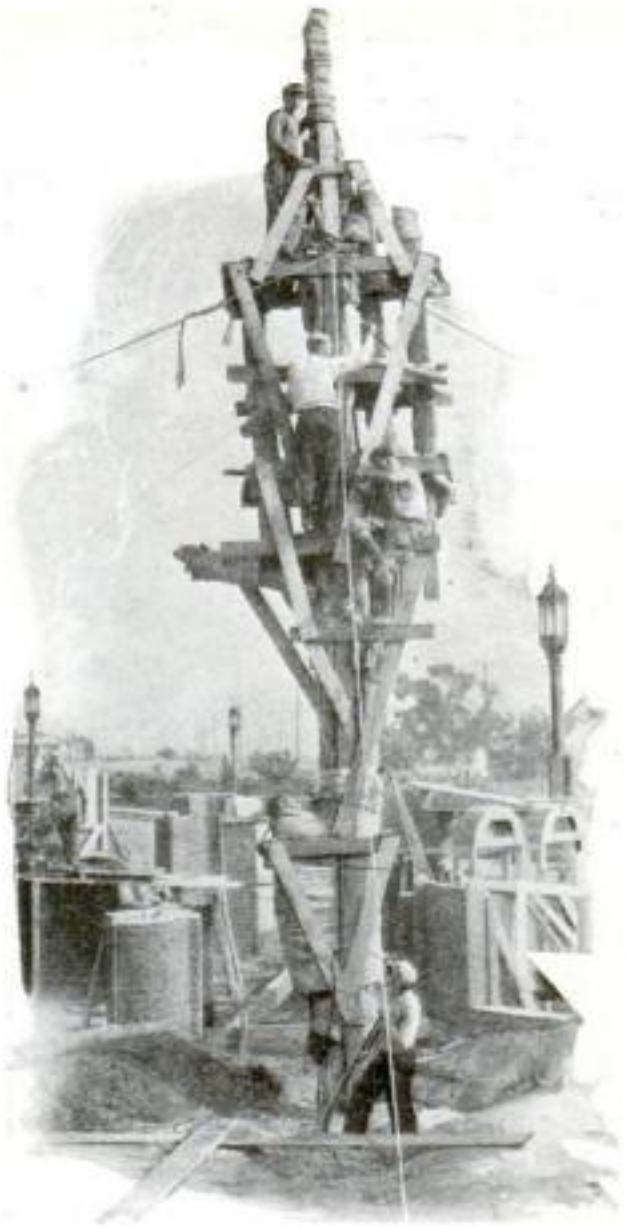
Top photo shows Gov. Gardiner of Maine engaged at job of shearing his sheep. In oval, 200-year-old spinning wheel with which it is intended to spin yarn for new clothes

At left is the ancient loom used in Colonial days and upon which Maine's Governor expects to weave cloth from the wool grown on his private sheep

INVENTS PICK FOR DINOSAUR HUNTERS

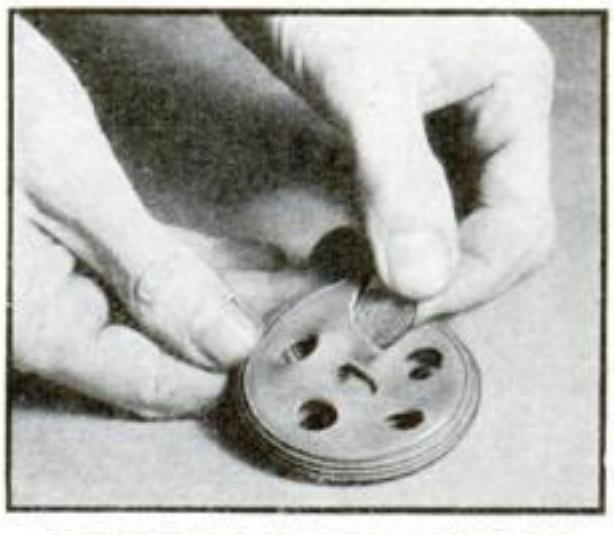


A MUSEUM curator recently turned inventor to design a pick especially suited for dinosaur hunters, since no tools on the market quite satisfied their needs. The large photograph shows Barnum Brown, curator of fossil reptiles at the American Museum of Natural History and inventor of the "dinosaur pick," demonstrating how the short-handled tool would be used in scraping ground for fossil bones. A metal, U-shaped inset, indicated by the arrow in the close-up view, keeps the metal head from biting into the wood.



CACTUS, 36 FEET TALL, IS MOVED 400 MILES

AMATEUR gardeners can appreciate the magnitude of a task performed the other day in California, where a cactus plant thirty-six feet tall was successfully transplanted to a site 400 miles away. The feat was undertaken by Leroy W. Gast, landscape engineer, and a crew of five men, to beautify a Los Angeles, Calif., business building's grounds. Braced with a protecting scaffold of wood, as shown in the photograph above, the twelve-ton plant was loaded on a truck and trailer for the long journey to its new home.

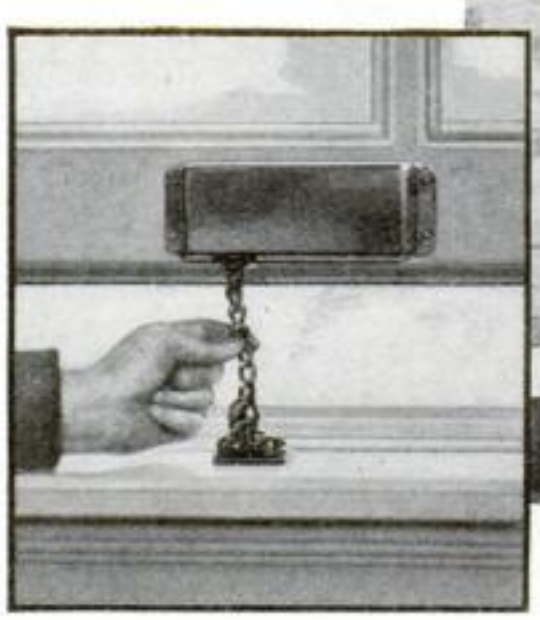


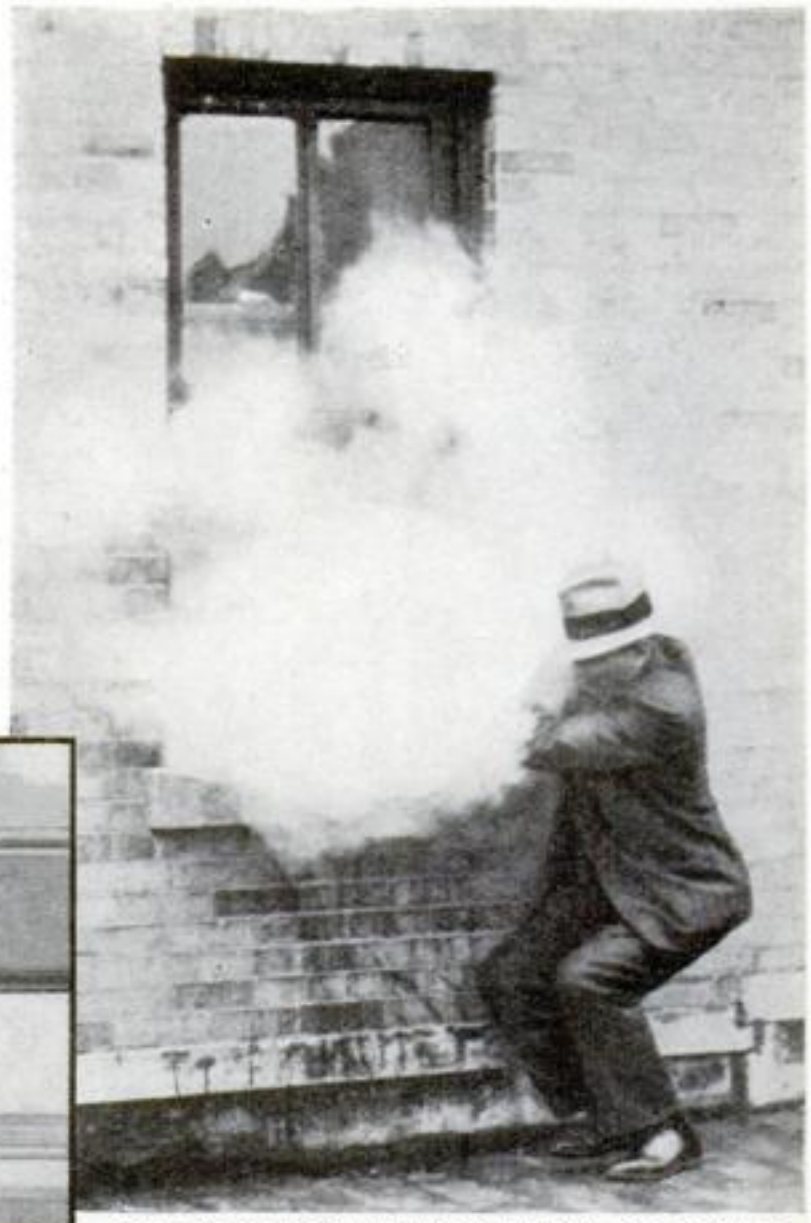
COIN PURSE OF RUBBER

A RUBBER change pouch is the latest thing in purses. It consists of a hollow disk about two and one half inches in diameter, perforated by five pairs of holes, three eighths of an inch in diameter each, spaced at equal intervals around the center. Coins of any size, forced through the holes, cannot drop out accidentally.

WINDOW FIRES TEAR GAS AT KIDNAPER

DEVICES to foil would-be kidnapers are now occupying the attention of inventors, and an ingenious apparatus recently developed for this purpose consists of a tear gas cartridge to be attached to a nursery window. Any attempt to raise the sash from the outside, beyond the limit of a guard chain, releases the cartridge's trigger. A burst of acrid gas blinds the intruder and renders him temporarily helpless. According to the Pittsburgh, Pa., inventor, the device also offers efficient burglar protection wherever installed on a window or door.

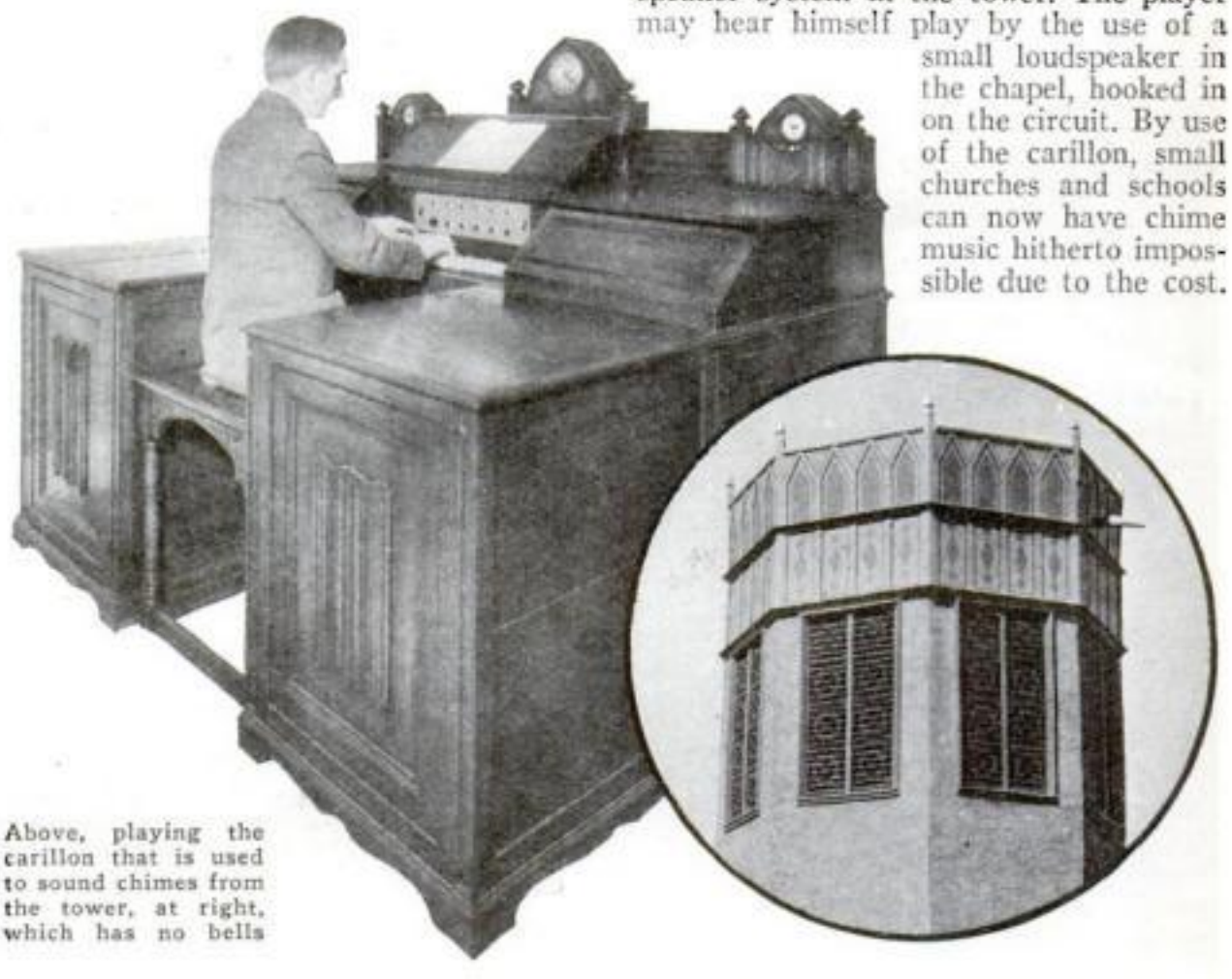




Tear gas cartridge fastened to window, left, which is discharged when sash is raised beyond limit set by chain. Above, how the gas would be shot into the face of kidnaper, rendering him temporarily helpless

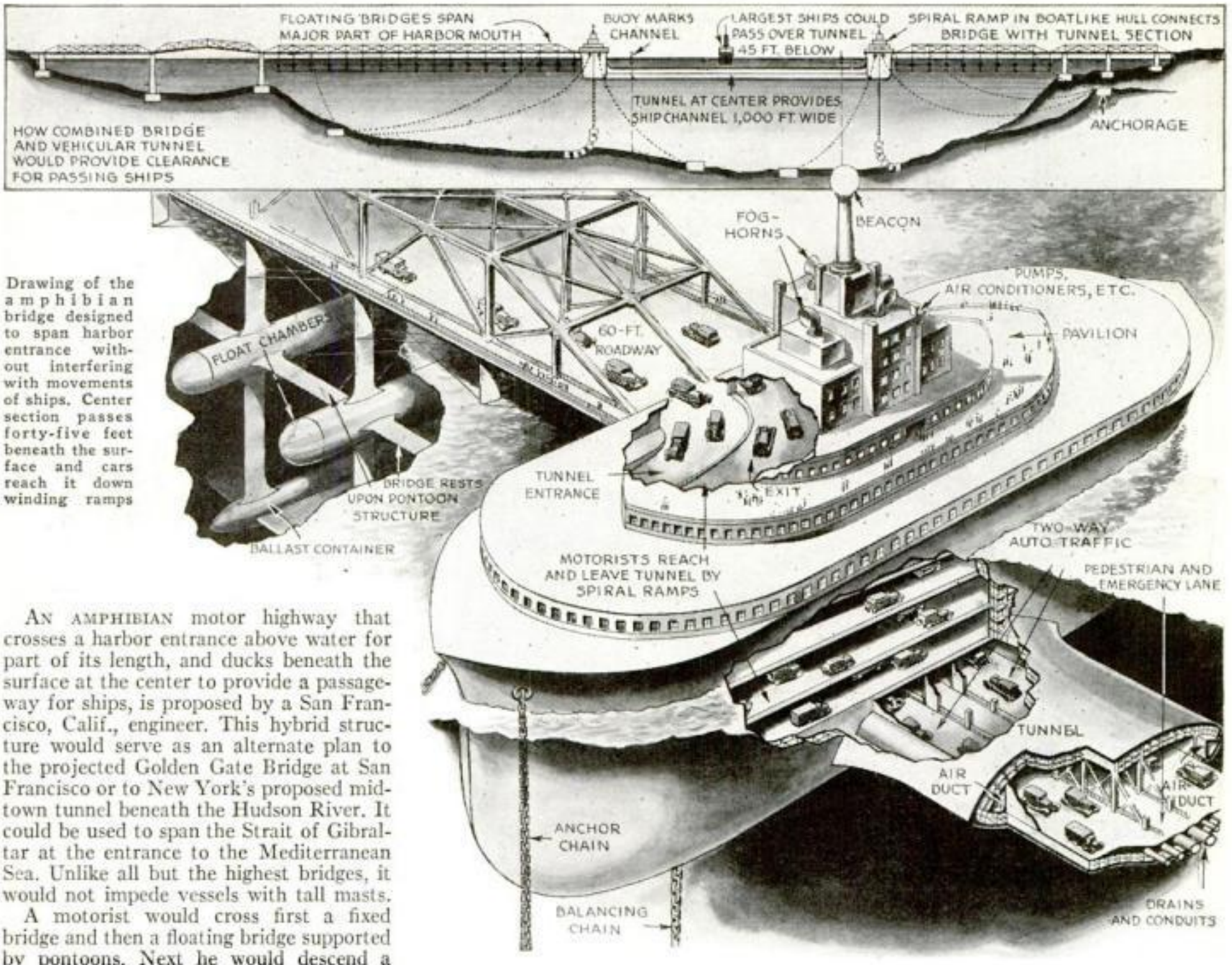
NO BELLS IN TOWER THAT SOUNDS CHIMES

THERE are no bells in the belfry of a carillon tower recently dedicated at Lakeview Memorial Park, in southern New Jersey, yet beautiful chimelike notes come from it. The installation is an adaptation of the new "electric carillon" developed by RCA-Victor Company engineers. Seated at an organlike console in a chapel 1,000 feet from the tower, the carillon player depresses keys of a forty-nine-note keyboard. As the keys are struck, tiny hammers strike tuned metal reeds. Their tones, magnified electrically by a powerful amplifier, are projected through a loudspeaker system in the tower. The player may hear himself play by the use of a small loudspeaker in the chapel, hooked in on the circuit. By use of the carillon, small churches and schools can now have chime music hitherto impossible due to the cost.



Above, playing the carillon that is used to sound chimes from the tower, at right, which has no bells

Engineer Designs Bridge-Tunnel to Span Entrance to Harbor



Drawing of the amphibian bridge designed to span harbor entrance without interfering with movements of ships. Center section passes forty-five feet beneath the surface and cars reach it down winding ramps

AN AMPHIBIAN motor highway that crosses a harbor entrance above water for part of its length, and ducks beneath the surface at the center to provide a passageway for ships, is proposed by a San Francisco, Calif., engineer. This hybrid structure would serve as an alternate plan to the projected Golden Gate Bridge at San Francisco or to New York's proposed midtown tunnel beneath the Hudson River. It could be used to span the Strait of Gibraltar at the entrance to the Mediterranean Sea. Unlike all but the highest bridges, it would not impede vessels with tall masts.

A motorist would cross first a fixed bridge and then a floating bridge supported by pontoons. Next he would descend a spiral ramp to a level forty-five feet beneath the water's surface. A floating tunnel 1,000 feet long, supported mainly by its own buoyancy, would lead him to another spiral ramp for the ascent, to another bridge, and thence to land. Floating parts would be securely anchored, while guard chains strung between buoys would protect the bridge-tunnel against unmanageable ships. The inventor, Cleve F. Shaffer, declares that each of the principles of the invention has been applied successfully elsewhere, and he has simply combined them.

In the event of war, the tunnel-bridge could be removed and towed away.

FLAT TIRE ALARM SNAPS SIGNAL TO DRIVER

TIMELY warning of a puncture is given by a new flat tire alarm. When it is mounted upon an automobile wheel, this invisible watchman remains silent as long as normal air pressure is maintained. When the air goes out of the tire, a plainly audible click, resembling the sound made by the metal "crickets" of elevator starters in office buildings, is heard at each revolution of the wheel. The device is installed between the rim and the tire, as shown in the photograph above.

NEW WATER CURE RESTORES WASTED MUSCLES

Floating in this portable tank, a patient with wasted muscles indulges in gentle exercise that effects cure without straining injured member

PATIENTS with atrophied muscles or injured ligaments may regain the use of their crippled limbs through an underwater cure demonstrated recently before the American Medical Association. Immersed in water, a grown man is so buoyed up as to be reduced to the weight of a baby. Gentle exercise without strain, thus made possible, restores his strength. For hospitals unable to install a large pool for the treatment, known as "hydrogymnastics," a portable tank has been developed.

UNUSUAL PICTURE OF EINSTEIN TOWER

In the background is the Einstein tower at Potsdam, Germany, and in the foreground is astrograph to observe light rays

FANTASTIC enough for a futuristic stage setting appears the scene pictured at the left, but the objects in it are real and practical. The photograph was taken upon the grounds of the famous Einstein Tower near Potsdam, Germany. This tower, seen in the background, houses many of the delicate astronomical instruments with which Prof. Albert Einstein developed his theory of relativity. In the foreground, Dr. von Klueber, one of Einstein's associates, is peering into an "Einstein telescope" or astrograph, used to observe the deflection of light rays in passing the sun's disk, one of the proofs in support of the Einstein theory.

SPOUT IN ORANGE LETS USER DRINK THE JUICE

A BOON to those who enjoy sucking the juice of oranges is a little aluminum spout recently invented for the purpose. Its sharp end is inserted in the top of the orange with a twisting motion, the resulting round piece of peel removed, and the spout replaced. This time it is forced in all the way up to a round rubber gasket. Squeezing the orange with both hands causes a fountain of juice to run down the spout, which is held to the lips or over a glass. The device is especially popular in Florida orange-raising districts, where it is fitted with a container and carried in the pocket like a drinking cup. Use of the spout eliminates the bother of removing the entire peel of the orange and allows all of the juice to be saved.

LIGHT WHEELBARROW MADE OF ALUMINUM

SO LIGHT that a woman or child can easily handle it, a new wheelbarrow weighs but thirty-seven pounds. Skillful design and choice of materials, however, give it the strength of much heavier barrows. Everything but the axle is made of aluminum or aluminum alloys. Tubing is used for the handles and the wheel disk is cut from heavy plate.

Made almost entirely of aluminum or its alloys, this wheelbarrow weighs only thirty-seven pounds

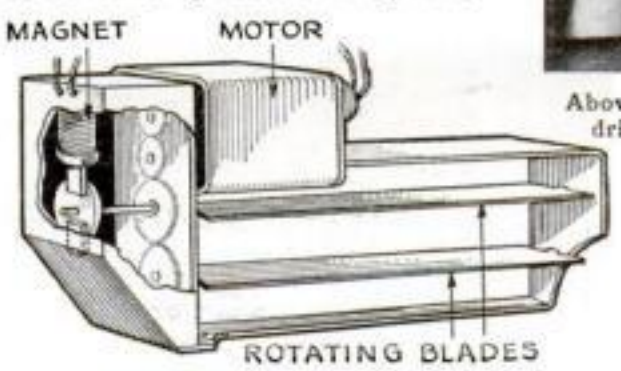
SPRING IN SCREW DRIVER STARTS WOOD SCREWS

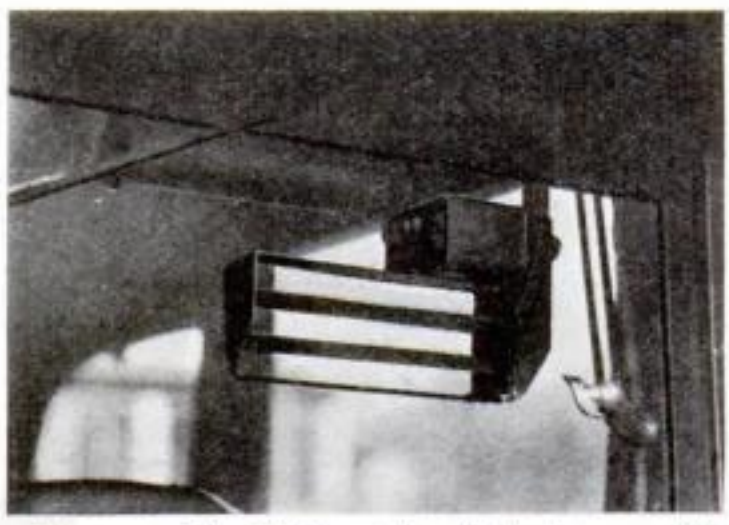
BALKY wood screws are easily on their way with a screw driver that has a spring in its shank. The handle may be drawn back slightly under the tension of the spring. When it is released, it applies a smart tap to the head of the screw, causing the threads to bite into the wood and obtain a firm hold. The screw driver then forces the screw home in the usual way. Screws tight from rust or paint also can be removed with the new tool, it is claimed.

A spring in handle throws blade against head of a screw to start it into place

WHIRLING BLADES END HEADLIGHT GLARE

BASED upon an entirely new principle, an anti-glare device just perfected for night drivers by a Boston, Mass., eye specialist uses whirling blades to shield the eyes from an approaching car's headlamps. The effect is similar to looking through the moving blades of an electric fan. Inclosed in a small frame, the device is installed on the inside of the windshield, where the air currents it produces keep the glass from steaming or fogging. The blades are stopped and held edgewise by a magnet for daytime driving. The inventor, R. E. Eaves, says his device is designed to conform with modern theories of the eye's response to changing illumination.





Above, revolving blades cut headlight glare so night driving is safer. At left, diagram shows how it is done

Women's Summer Clothes Only One Sixth as Heavy as Men's

Do WOMEN dress more sensibly for the warm weather months than men do? Two piles of clothing, selected as typical in a recent research of the Holland Institute of Air-Conditioning, afford an interesting commentary. One of these weighs less than a pound, representing the average woman's costume with the exception of shoes. The other is a man's costume, weighing nearly six times as much, a virtual "armor" for the perspiring male.

A surprising result of the experiments performed at the Institute, however, was the discovery that people perform light work best at temperatures just a little higher than those at which they are comfortable. When subjects were set to sorting marbles, corks, dice, and other objects previously mixed in a bowl, their work was found fastest and most nearly accurate at temperatures between seventy-five and eighty-six degrees F., with a relative humidity of about sixty percent—corresponding to a hot, but not a sticky, summer day.

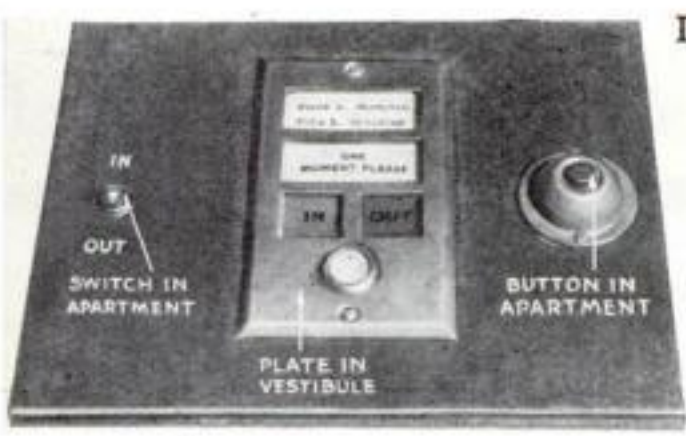
On the scale, right, are the clothes worn by a woman in summer. At the left are those worn by a man

Tests at the Holland Institute show that light work is done faster and with greater accuracy when the temperature is just a little uncomfortable

NEW RED LIGHT BULB CAN'T GO OUT

A NEW bulb for use in traffic lights and railway signals, that will eliminate accidents caused by red light failure, has been designed by Charles Adler, Jr., Baltimore, Md., signal engineer. When a red stop signal fails in auto traffic control a driver, seeing no light, is likely to crash into cars crossing the other way. Adler's new bulb is fitted with two filaments separated by a shield so that if failure of the first filament brings the second into action half the red light shows, guarding traffic until a new bulb is installed.

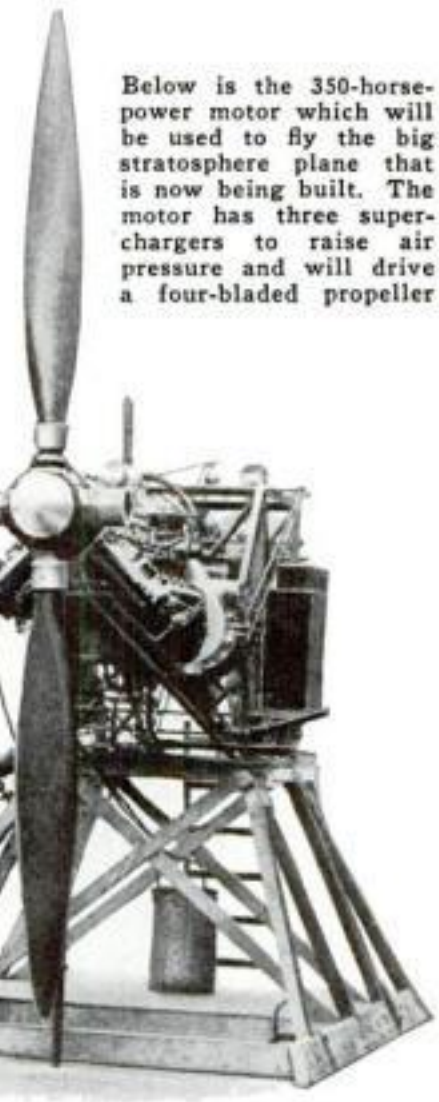
Charles Adler, Jr., Baltimore, Md., exhibits his new traffic signal bulb. Diagram shows how second filament lights half of red signal light



When callers press the doorbell button this automatic signal at once flashes "out" or "in" reply

DOORBELL TELLS CALLER IF PARTY IS IN OR OUT

So VISITORS need not linger on the doorstep wondering whether an apartment house dweller is at home, a device has been invented that gives an immediate answer when the doorbell is pressed. The word "in" or "out" appears above the button in response to the ring, followed by the click of the door latch as soon as the party is ready to receive his callers. A switch, set by the resident, controls the automatic announcer.



Below is the 350-horsepower motor which will be used to fly the big stratosphere plane that is now being built. The motor has three superchargers to raise air pressure and will drive a four-bladed propeller

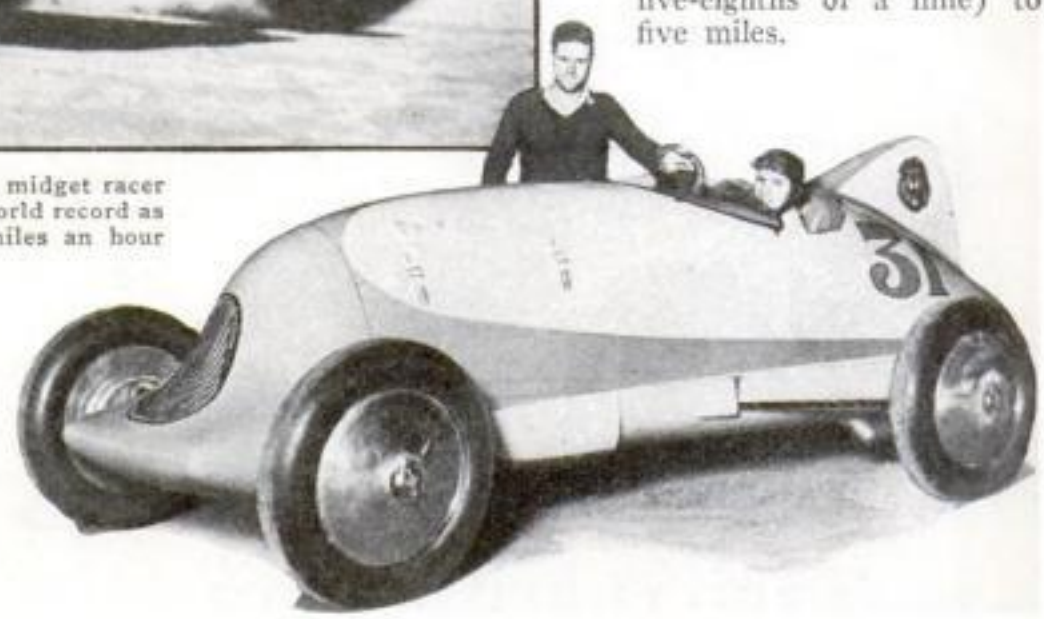
STRATOSPHERE PLANE'S MOTOR GETS FIRST TEST

WHILE the frame of a giant airplane being built for a flight into the stratosphere at the Farman works in France nears completion, its novel 350-horsepower motor recently received its first tests. The new motor has three superchargers arranged to elevate the air pressure in successive stages, permitting much higher flight than would otherwise be possible. To dissipate the heat generated by the movement of the superchargers' blades, the air passes within finned radiators on its way to the carburetor.

Midget Car, Streamlined for Speed, Goes 147 Miles an Hour

MIDGET cars for use on regular race tracks are now streamlined like the juggernauts that have set the world's "heavyweight" auto speed records on ocean beaches. The bullet-shaped machine illustrated here, with scoop-shaped nose and an airplane tail fin, was designed especially to meet a minimum of wind resistance. In preliminary trials on a dry lake bed in California, it vindicated its builder's hopes by covering one mile at 147 miles an hour, a record for cars of its size. It also set three other new marks for different distances from one kilometer (equivalent to about five-eighths of a mile) to five miles.

New streamlined midget racer in test run sets world record as it goes at 147 miles an hour



The new racing car has scooped nose and tail fin, which give it the appearance of the big cars that are run on sand of Florida's beaches

NEW ZINC-VAPOR LAMP HAS STRONG RED GLOW

DECORATIVE lighting and color photography may find uses for a "zinc-vapor lamp," a new form of illumination just perfected by the research laboratories of the Westinghouse Lamp Company. It emits a strong red glow. When used in combination with other tubular lamps, it makes up for their deficiency in red rays; for example, a good quality of white light is obtained by setting up the new lamps beside mercury-vapor lamps. A possible application is foreseen for the "zinc-vapor light" in sorting red apples from green ones, as under its light the former would appear a vivid red and the latter black.

This new zinc-vapor lamp throws a red glow that may prove useful in photography, in decorative lighting, and in sorting of fruit

HYDRAULIC JACKS SPREAD BRIDGE ARCH

AN OUT of the ordinary engineering feat was accomplished successfully in England the other day, when ten hydraulic jacks were used to force apart two halves of a reënforced concrete arch of the new Chiswick bridge in the outskirts of London. The 5,000,000-pound push was applied to take up any shrinkage that might have occurred in the concrete. Ten massive jacks were sunk in shallow pits and were worked simultaneously from a central control apparatus. The feat provided a striking demonstration of the application of mechanical principles of leverage, through which the slight strength of a man's arm is magnified to mighty proportions.

At right, one man working lever that applied, through ten hydraulic jacks, a pressure of 5,000,000 pounds to bridge arch. Upper right, installing one jack

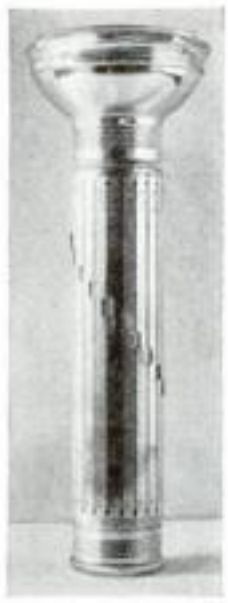
Light Beam Carries Secret Message from Aircraft to Field

SECRET communication between military aircraft and ground headquarters was forecast in an experiment at Schenectady, N. Y., when a newly perfected system known as "narrowcasting" transmitted voices from the Navy airship *Los Angeles* to the earth 2,500 feet below. A flickering beam of light, modulated by sounds entering the transmitting microphone, replaces radio waves to carry the message in this new system. Unlike radio waves, the light beam is easily focused and aimed at the receiving station, where a curved mirror and an electric eye pick up the signals and render them audible in a loudspeaker. No one outside the beam's path can intercept the message. The photograph below shows the signals being carried to radio fans by a broadcasting station.

From the Navy dirigible *Los Angeles* a message was sent to the land station, left, over a beam of light

Message sent over light beam was caught by electric eye and relayed on to radio fans

UNUSUAL FLASHLIGHT GIVES AIR'S HUMIDITY



A FLASHLIGHT, recently placed upon the market, bears upon its handle a device for computing the relative humidity of the air. The combination instrument is intended especially for workers in lumber-drying kilns, where evaporation is controlled by humidity, enabling them to read hygrometers in the dark and compute the moisture content of the air from figures on the flashlight handle.

THIS CARPENTER'S SAW HAS REMOVABLE BLADE

WHEN a carpenter's saw, invented by a San Francisco mechanic, becomes dull, the edge may be removed and thrown away. The tool is provided with three interchangeable blades. Each one may be replaced at less than the cost of filing the old teeth sharp. While it is in use, so firmly does the blade cling to the handle, held, according to the inventor, by a suction, that a tool such as a nail set must be used to pry it off after its service is ended.

Three blades come with this saw, so no sharpening is done

MOTOR-DRIVEN HANDSAW CUTS THIN MATERIAL

DESIGNED for cutting wallboard and for light tasks, a compact electric handsaw was exhibited recently by its inventor at San Francisco. Its circular saw blade, no larger that the palm of the hand, is driven by an electric motor above the handle. The latter is constructed in the form of a pistol grip, and a trigger serves as a switch to start and stop the motor.

WORKBENCH OILSTONE RUN BY ELECTRICITY

ELECTRICITY runs a new oilstone for the home workbench, taking the drudgery out of sharpening chisels, plane irons, and knives. Tools are held against the horizontal revolving disk in the same position as upon a hand oilstone, but without moving them, insuring a steadier hold.

Electrically operated, this oilstone for home workbench turns beneath tool edge to sharpen it

Anyone Can FLY – *but*

By
RANDY
ENSLOW

In landing, a pilot must fly a ship every second of the time. Even after the wheels touch the ground, he has to take care the machine doesn't ground-loop and dig one wing into the ground as in this unusual photo

A YOUNG pilot was applying for a job at an airport.

"Want to see me fly?" he asked the manager.

"No, I don't want to see you fly. I want to see you *land*. That's the test."

The manager was right. You can tell more in one minute about a pilot's skill when he is landing than you can in ten when he is in the air.

An old axiom of the hangars has it: "Anyone can fly. But it takes a pilot to land."

The last and hardest thing a student learns is how to come down. Even old-timers, who have been handling ships for years, learn new lessons from every unusual or emergency landing. The thirty seconds before the wheels touch are the most important in the average flight. For example:

One boiling August day in 1929, I was coming down from a test hop in a cabin Fairchild at Roosevelt Field, Long Island. As I slid over the south boundary fence into a twenty-mile-an-hour wind, a brown funnel of dust came racing across the field. It was one of those midsummer whirlwinds you see picking up dust and leaves on hot August days.

The Fairchild was thirty feet in the air, settling down for the landing, when the air-swirl hit the left wing. It tossed it into the air like a piece of paper. In a flash, the ship was thrown almost into a vertical bank. Then, the swirl charged away to the rear. I had just enough height to pour in the gun, racing the motor, and roll back on a level keel before the wheels touched.

All over in the winking of an eye, it illustrates the unexpected, split-second happenings that may occur just before the wheels hit. In landing, you have to fly a ship every second. Even after the wheels are on the ground, you have to watch that the machine does not "groundloop," or run around in circles digging in one wing.

Unless a pilot is coming down with a dead engine, he keeps his hand on the throttle, a little knobbed lever at the left side of the cockpit, all the time, ready to

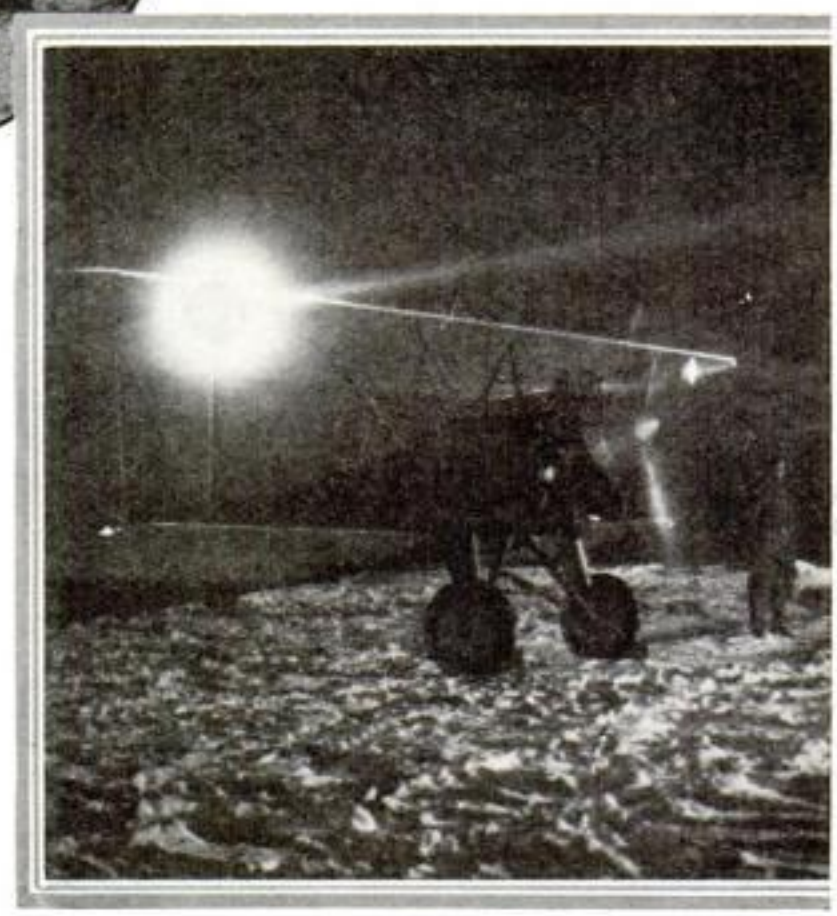
Randy Enslow, right, directs his mechanic who is adjusting the landing gear

open the motor in an emergency. On long glides, he usually "blimps" the motor frequently, giving it brief bursts of speed to keep it from fouling up on the way down.

The strangest case I recall in which slamming on the throttle at the last minute pulled me out of a jam occurred near Jefferson City, Mo., six or seven years ago. My brother, Wilder Enslow, and I were barnstorming in a pair of Hisso-Standard biplanes. The only good landing spot we could find near the city was a big pasture half a mile from town. We circled twice to look over the lay of the land. Then I started down.

In the shade of an oak tree, at one side of the field, a dozen cows were chewing their cuds. None of them seemed to pay any attention to us. In landing, a pilot usually keeps his eyes on the field from thirty to fifty yards in front of the plane as he nears the ground. I was leveling off, with the wheels almost touching, when I saw one of the cows wandering out into the field directly in front of the ship. She saw me at the same instant and started down the field, tail up, setting a world's sprinting record for spotted cows. I shoved ahead the throttle. The Hisso engine took hold with a roar. We picked up just enough speed to let me lift the right wing a few inches and avoid a crash. It raked along up the cow's back. Hair flew over the top of the wing like grass coming from a lawn-mower. Then the Standard climbed into the air. The cow picked up a little more speed and the last I saw of her she was heading down the field almost fast enough to take off.

In coming down for a landing, as you near the ground you ease back the stick, lifting the nose of the plane so the machine levels off a few feet above the field. As it loses flying speed, you pull back the stick still farther, dropping the tail to make a



NIGHT LANDING. A perilous undertaking in early days

Only a Pilot *Can Land*

Thrilling Moments in Bringing a Plane Down in Emergencies and the Secrets of Landing Are Described in This Article

The author in person, in the cabin of a big plane, ready to take off on a cross-country flight to deliver late New York newspapers

"three-point landing" with the two wheels and the tail skid touching the ground at the same instant. The fact that the tail drops suddenly makes the plane appear to sit down and gives rise to the airport term for landing, "sitting down."

The hardest part is knowing when to level off. If you wait too long, you strike the ground at an angle and bounce. If you don't wait long enough, you stall in the air and "pancake" with a smack that might wreck your landing gear.

I remember one student who made his first solo at Lambert Field, in St. Louis, Mo. He started his glide all right, then got "ground-shy" and leveled off too soon. His instructor, watching beside a hangar, yelled to the mechanics inside:

"Boys, run out and jack up the airport! He's going to land twenty feet up!"

Sometimes a pilot levels off high intentionally, as, for instance, when he comes into a strange field at dusk. It enables him to clear unseen obstacles and by "side-slipping," or kicking over the rudder so the plane moves sidewise momentarily and acts as a powerful brake, he can lose the height and land normally.

One landing of this kind, four or five years ago, gave me an exciting adventure in the Mohawk Valley of New York. Cows again figured in it, and I didn't know how exciting it really was until the next day.

I was flying an Oriole, with a Curtiss "Six-in-Line" engine, west of Albany. A pinhole leak in an aluminum pipe of the cooling system allowed water to squirt out as soon as the pump started working. Beyond Schenectady, the temperature gage showed the engine getting hotter and hotter. Near Amsterdam, the water began to boil. I expected the overheated motor to cut out any minute. To the west, the sky was still flame-red above the hills, but, in the valley below, dusk had fallen. I could just make out, in the gloom, a large dark spot surrounded by lighter areas—a green pasture with fields of ripening grain around it on all sides.

I was leveling off, skimming the ship about fifteen feet or so above the ground, ready to sit down, when a dark blob on the ground grew larger and a cow went past. I looked ahead. In the faint light, I saw the end of the field was alive with cows. There were black, white, speckled ones. They were all lying down, looking like varicolored boulders in the dusk.

I gunned the engine. It gave one last burst of power and then cut out. But that added pull was enough to carry us over a stone fence into a wheat field beyond. The grain was nearly as high as my armpits. Only the fact that we landed at relatively slow speed, with the tail low from hurdling the fence, kept the Oriole from somersaulting in the tangle. As it was, she stumbled along, tail high and propeller almost hitting, for 150 feet before she stopped.

The next morning at sunrise I went out to look for the leak. I discovered something that made my hair curl. In hurdling the fence, the night before, the Oriole had gone between two steel standards under high tension wires carrying 63,000 volts. And I had missed seeing them entirely in the dusk!

The color of fields, as seen from the air, frequently aids a pilot in picking a place for sitting *(Continued on page 104)*

Airport dispatcher with red and green lights to guide arriving and departing planes at night

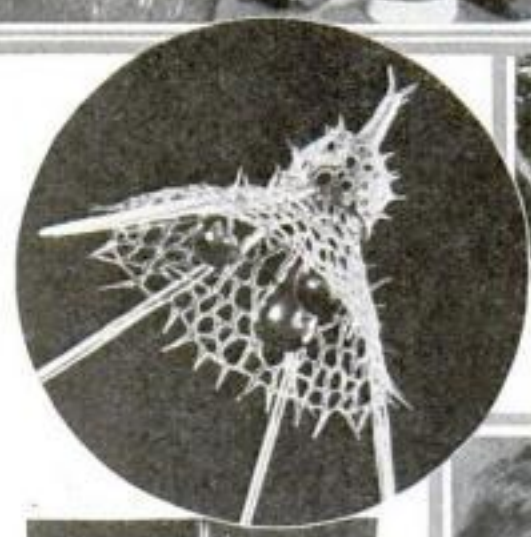
of flying, coming down at night is made safe by floodlights and the landing lights of planes

Glass Models of Invisible Creatures Made for Museum

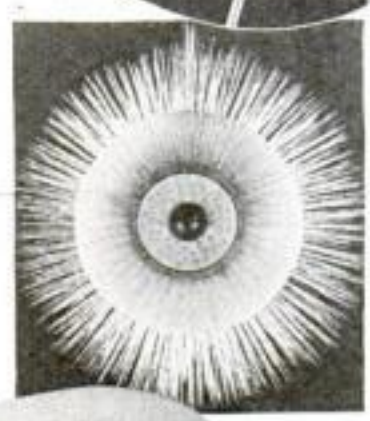
These models of creatures too small to see are made by H. O. Mueller for the American Museum of Natural History. Mueller is seen holding glass, tweezers, and carbon rod that are used in making the exhibits

ONE of the world's strangest professions is that of H. O. Mueller, veteran glass-blower at the American Museum of Natural History, New York City. With only a pair of tweezers, a rod of carbon, a blowtorch, and glass, he fashions models of invisible aquatic creatures. A drop of water from a pond contains thousands of living things that can be seen only with a microscope. Enlarged models of them, made by Mueller, are on exhibit in the museum. Especially beautiful are the microscopic jewels known as Radiolarians, a large family of minute protozoa of glassy structure. To make the models, the parts are blown from glass and fused together.

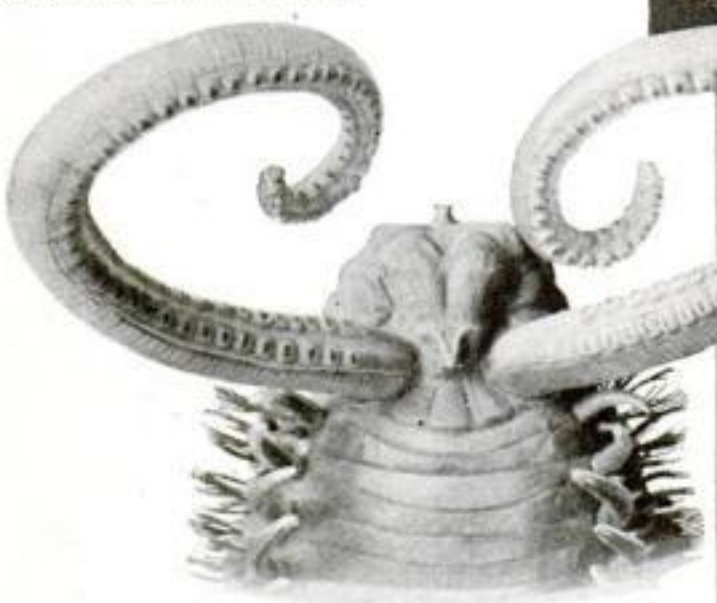
The delicate spikes in the intricate design of this Radiolarian require deft manipulation in making a glass model



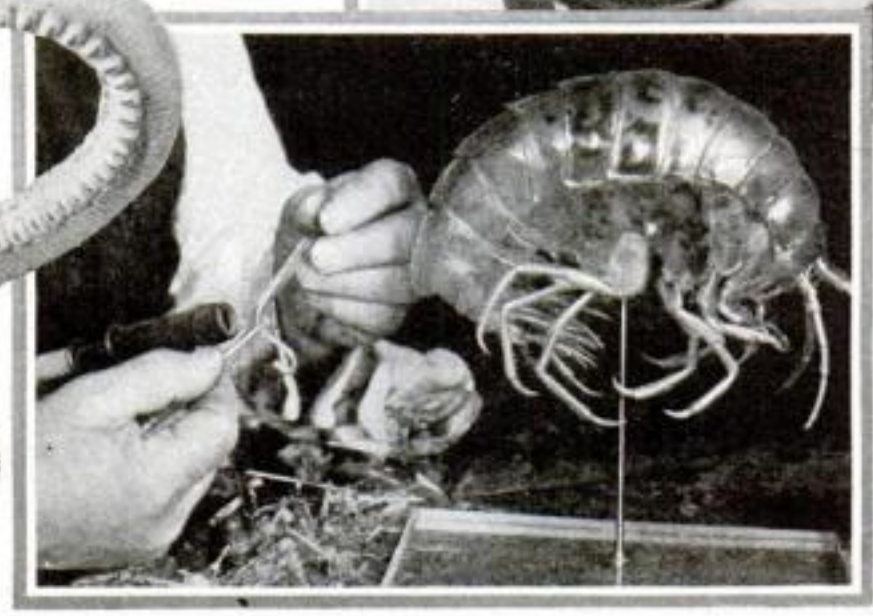
Above, typical view of pond water inhabitants, highly magnified, and made entirely of glass. In circle, a model blown in glass of an unusual specimen of a Radiolarian



At upper left, tiny Radiolarian which, in glass model, looks like a sunburst. After the models are finished, artists apply the colors as shown above



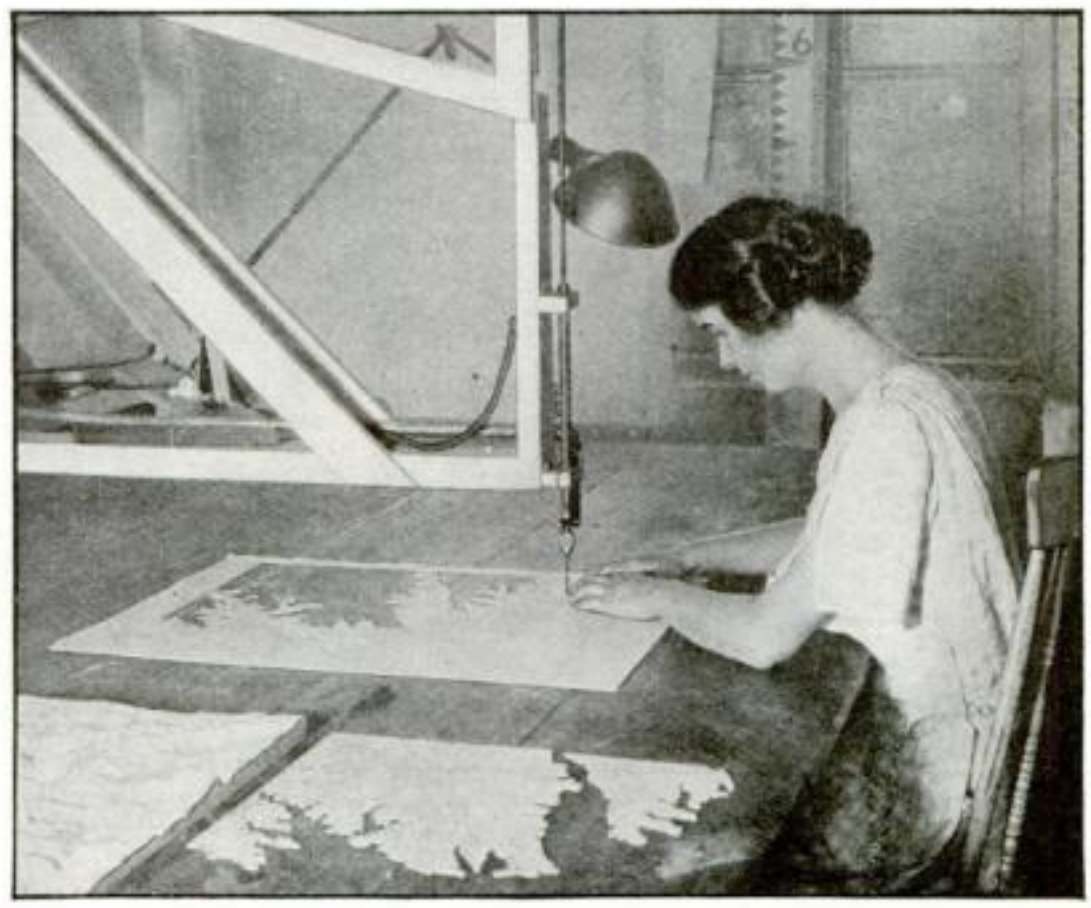
This sea worm, visible only in a microscope, is an evidence of skill shown in modeling tiny creatures



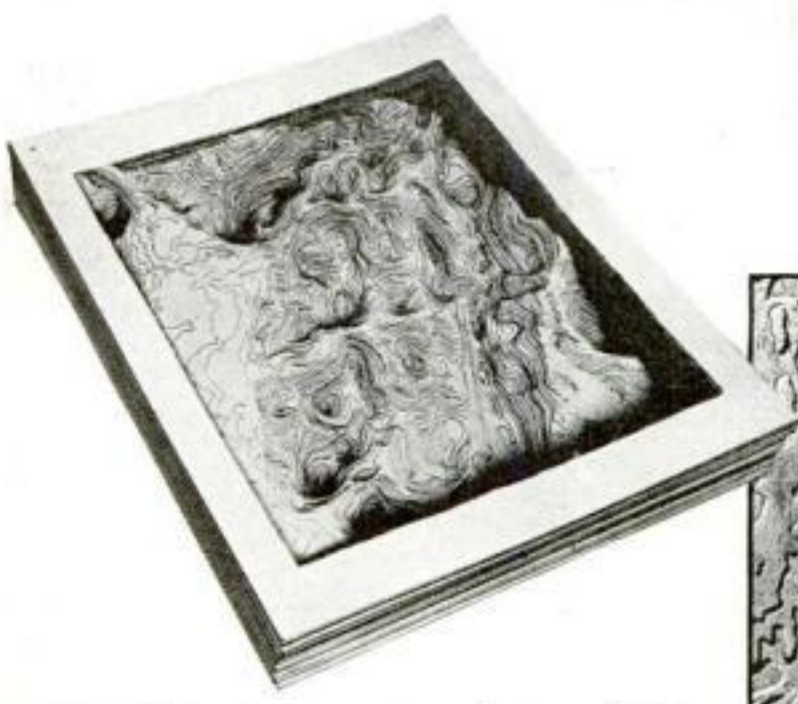
Picture at left shows work being done on a sea flea, the body of which has already been blown. The legs are fused to the body with blowtorch

Hills and Valleys on New Photo Maps

RELIEF maps that show at a glance the character of the country are now made for military and peacetime use, through a process devised by Major W. W. Kirby, head of the mapping section of the U. S. Army Corps of Engineers. Experience in the World War showed that many officers had difficulty in making tactical decisions from the maps then available. Conventional "contour maps," in which meandering lines connect points of equal altitude, meant little to one who has no specialized engineering training. Plaster models of the country in relief conveyed a much clearer picture of hills and valleys, but were cumbersome and fragile. The advantages of both have now been combined by casting a model from a mold of jig-sawed contour maps, photographing the model, and superimposing the photograph upon a standard contour map. Illustrations on this page give the steps of the process and show how vividly the paper map depicts hills.



1 In making the new maps, a relief model is first made. Copies of the map are glued to separate sheets of thick cardboard and jig-sawed out along successively lower contour lines starting with the highest, as pictured above



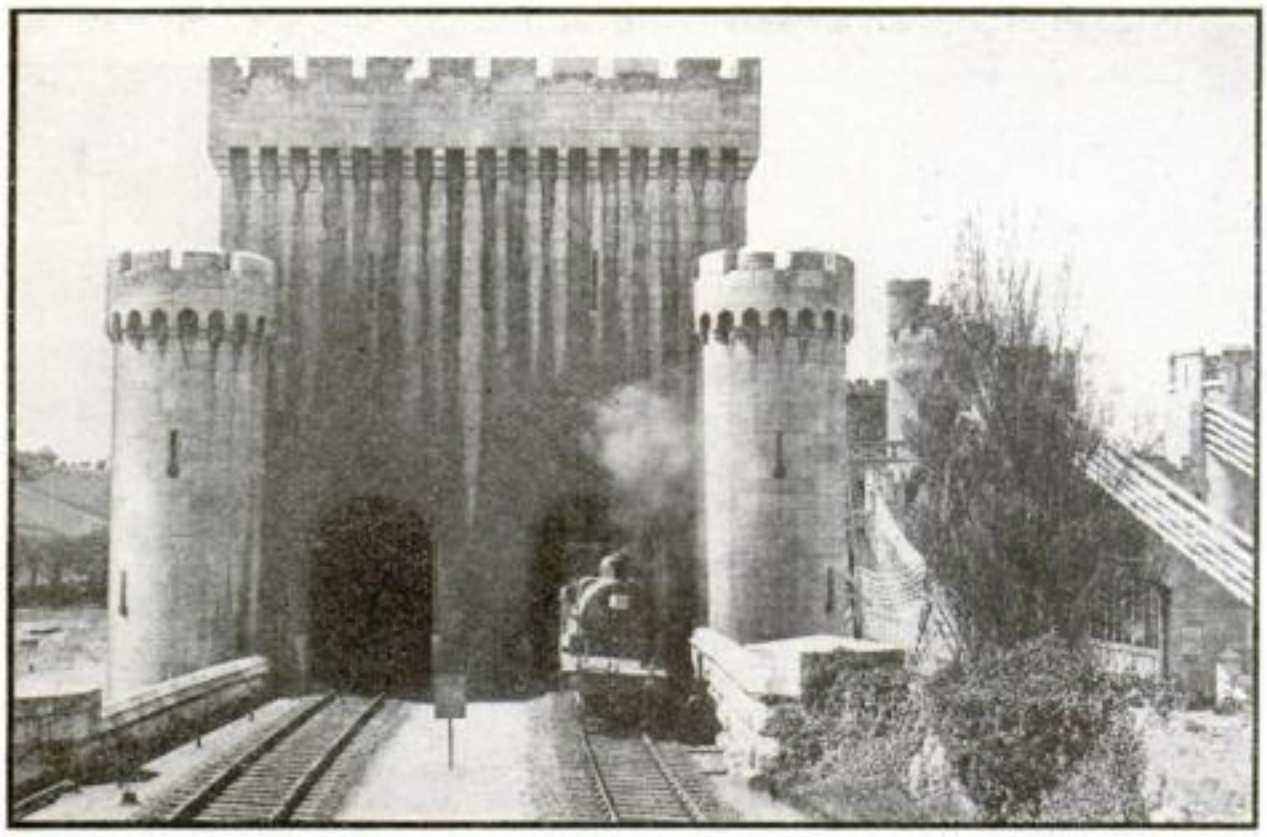
2 After all the pieces are cut out, they are glued in place, one on top of another, to form mountains and valleys. After waterproofing with shellac, a mold is formed in plaster. At right, a close-up of this cast shows the edges of the layers of cardboard which are smoothed out with modeling clay

3 Above, making a finished cast from the mold. Note that a wooden dam holds the plaster in place so that the process of drawing the cast is so simple that any moderately skilled worker can do it without running the danger of destroying the mold. In fact, this entire map-making method is dependent upon mechanical processes that are not liable to human error, so that the finished product is fairly certain to be accurate

4 Here is the final relief model which was made as shown in the lower left-hand photo. The mechanical process insures its accuracy in every detail. This model is set up in a strong light and photographs are made of it

5 At left is one of the finished relief maps. A halftone plate is made from a photo of the model above and this is printed over a copy of the original contour map in transparent ink so that all the contour lines and the other regular markings can be read without training or special knowledge

Imitation Battlement Hides Britain's Strangest Bridge



Medieval towers and battlements, designed to harmonize with the ruins of celebrated castle seen in background, hide a railroad bridge that spans river near historic grounds in Wales

A RAILWAY that runs through an imitation medieval setting is one of Britain's curiosities. When the main line road was projected, the best route ran through the grounds of historic Conway Castle, in North Wales. To bridge a river for the track without marring the landscape, architects designed towers in harmony with the ancient buildings, and trains now enter and leave the bridge beneath synthetic towers and battlements. The photograph shows a train emerging from the make-believe castle, while the ruins are visible in the background.

NEW MOTOR BURNS PULVERIZED COAL

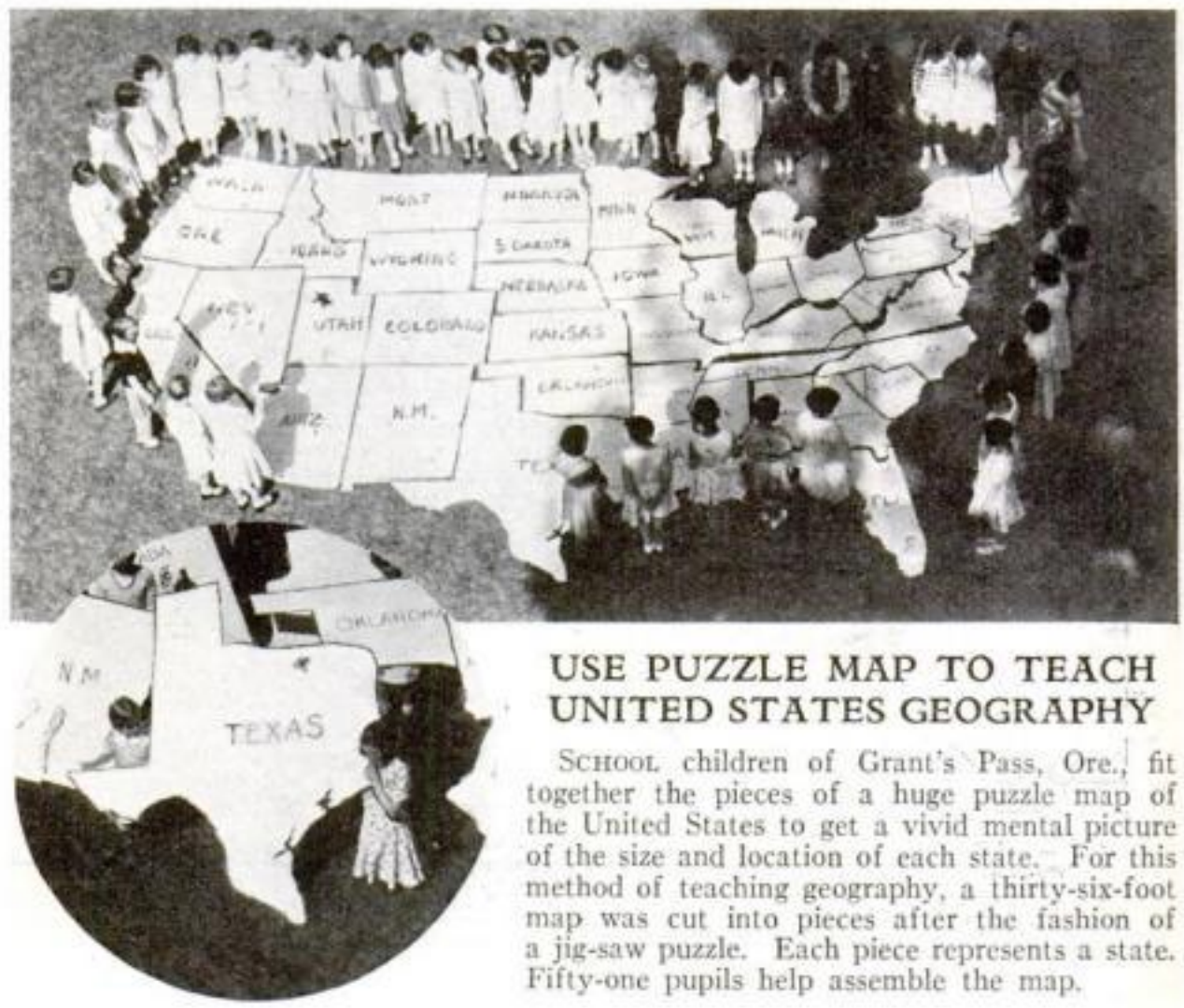
Upper view, new Diesel motor that burns coal. Lower view, the special fueling apparatus

WHEN Dr. Rudolph Diesel, noted German engineer, introduced the internal combustion motor that bears his name, it was said he contemplated the eventual development of Diesel-type engines that would use solid fuel instead of heavy oil. Now Diesel's former chief engineer and assistant, R. Pawlikowski of Goerlitz, Germany, announces that he has carried on the work of the dead inventor, and perfected a motor burning pulverized coal. Seven models have been built, and tests show that the cheapest grades of coal may be used, while the fuel consumption itself is declared lower than for other forms of power.

ABRASIVE STONE PUTS POINT ON FISHHOOKS

Abrasive stone used to sharpen fish-hook barb

BIG fish don't get away when the fisherman's hooks are kept sharp, is the claim made by experienced anglers, and a handy abrasive stone, designed especially for this purpose, has now been introduced. Less than three inches long, it is easily carried in the tackle box. One edge is beveled for getting around and under the barb and for pointing up small hooks. The other edge is curved for finishing up the points. Grooves on the flat sides are used to reshape badly dulled or blunted hook points. According to the manufacturer, only a few seconds work puts a hook in first-class condition.

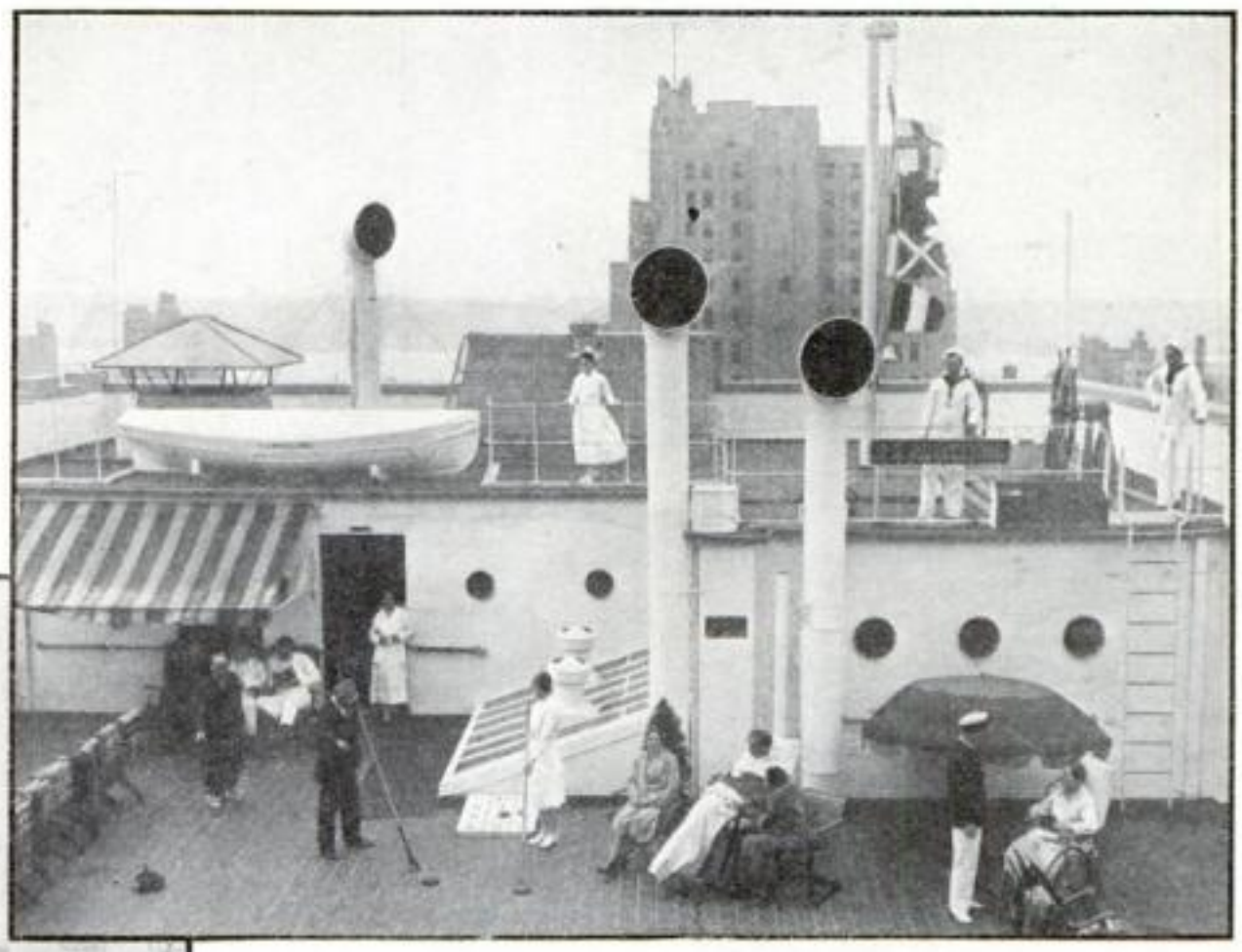


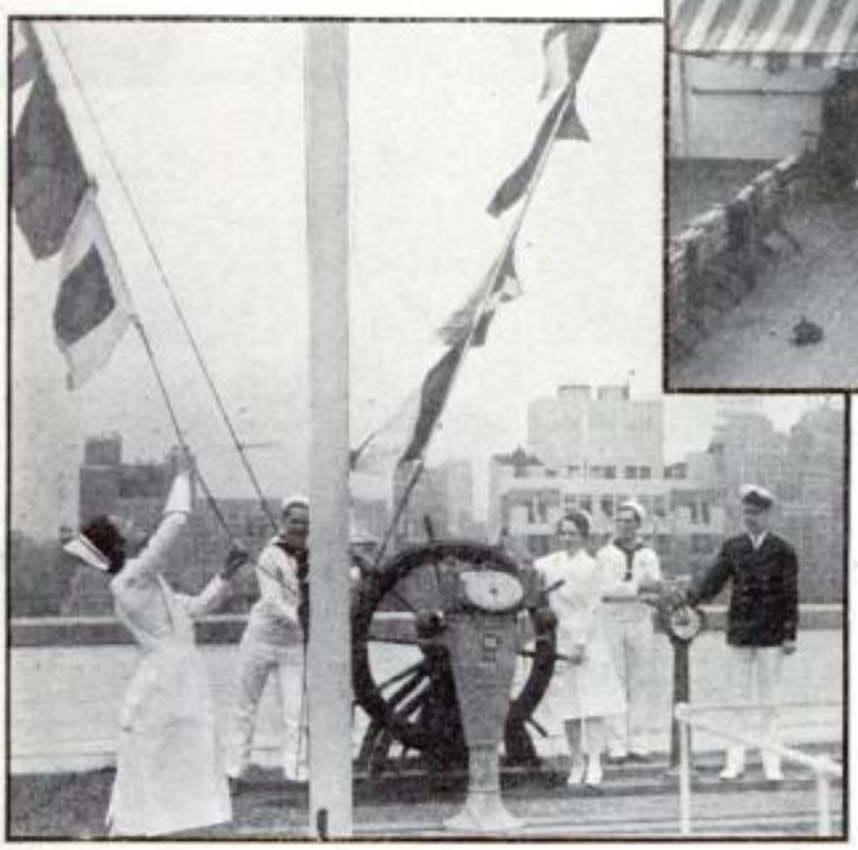
USE PUZZLE MAP TO TEACH UNITED STATES GEOGRAPHY

SCHOOL children of Grant's Pass, Ore., fit together the pieces of a huge puzzle map of the United States to get a vivid mental picture of the size and location of each state. For this method of teaching geography, a thirty-six-foot map was cut into pieces after the fashion of a jig-saw puzzle. Each piece represents a state. Fifty-one pupils help assemble the map.

Ship's Deck on Hospital Roof Speeds Patients' Recovery

WHISKED to the roof of one of the skyscrapers in the heart of New York City, a visitor may imagine himself on a big liner at sea. This "nautical roof," just opened by the New York Polyclinic Hospital, helps its convalescent patients lose the feeling of a hospital atmosphere, and speeds their recovery. Via a real gangplank, they enter a new world where hospital orderlies are dressed as sailors and nurses as stewardesses. Lifeboats inscribed "S. S. Polyclinic" hang over the edge of the make-believe deck on davits, and a ship's bell announces the time of day. The illusion is heightened by a ship's bridge equipped with navigational aids.





Rigged up in exact imitation of an ocean liner's deck, the roof of the New York Polyclinic Hospital brings a suggestion of sea to patients

The illusion of being at sea is heightened for the patients on the hospital roof by steering wheel, signal flags, and nurses and orderlies dressed as stewardesses and sailors

EXTRACT BROKEN BOLTS

After a hole is drilled in a broken bolt, a fluted tool is inserted and bolt is twisted out

REMOVING a broken bolt from a cylinder block without dismantling it is made possible by a set of tools now on the market. A hole is drilled in the fragment and then a tool with longitudinal flutes, of a spread a few thousandths of an inch larger than the diameter of the drill, is tapped into the hole. Another tool is then used as a handle to unscrew the piece of bolt.

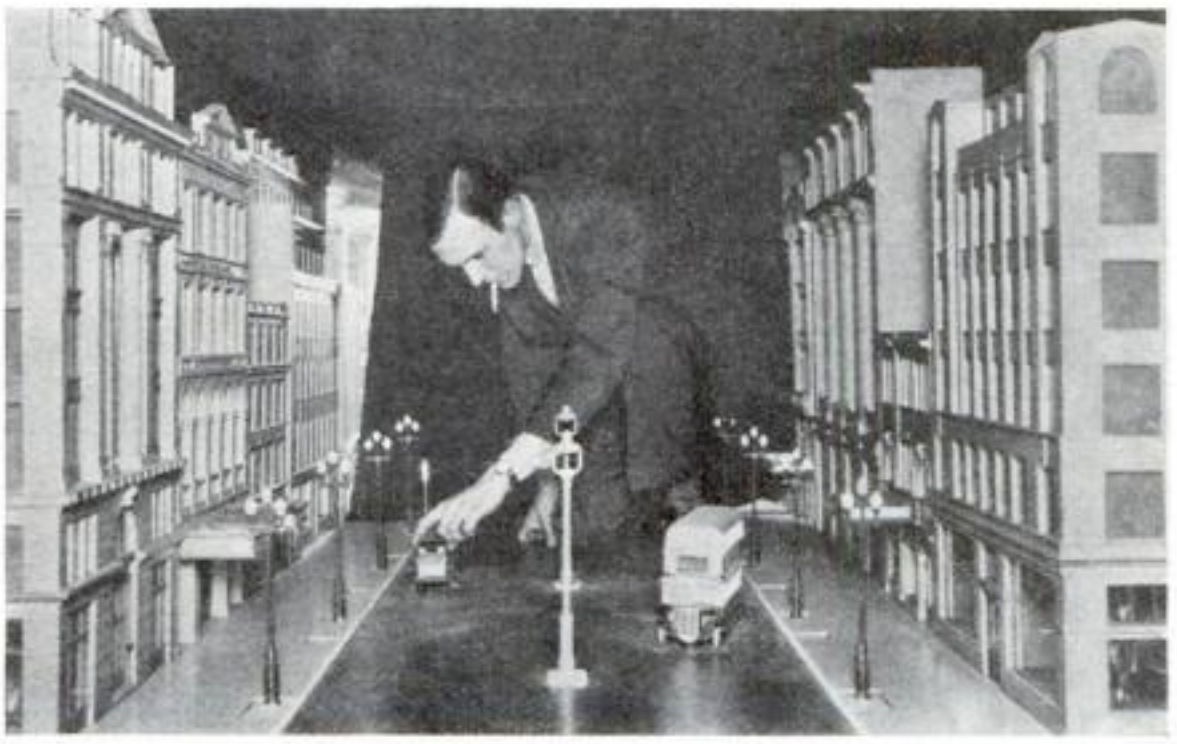
ELECTRIC EYE KEPT ON ICE

SO SENSITIVE is an improved electric eye now used at Yale University to measure the brightness and determine the color of stars that it must literally be kept on ice. The eye rests in a container surrounded by frozen carbon dioxide, or "dry ice." Variations of room temperature are thus prevented from influencing the measurements.

An electric eye, used to measure brightness of stars, is kept in container surrounded by dry ice

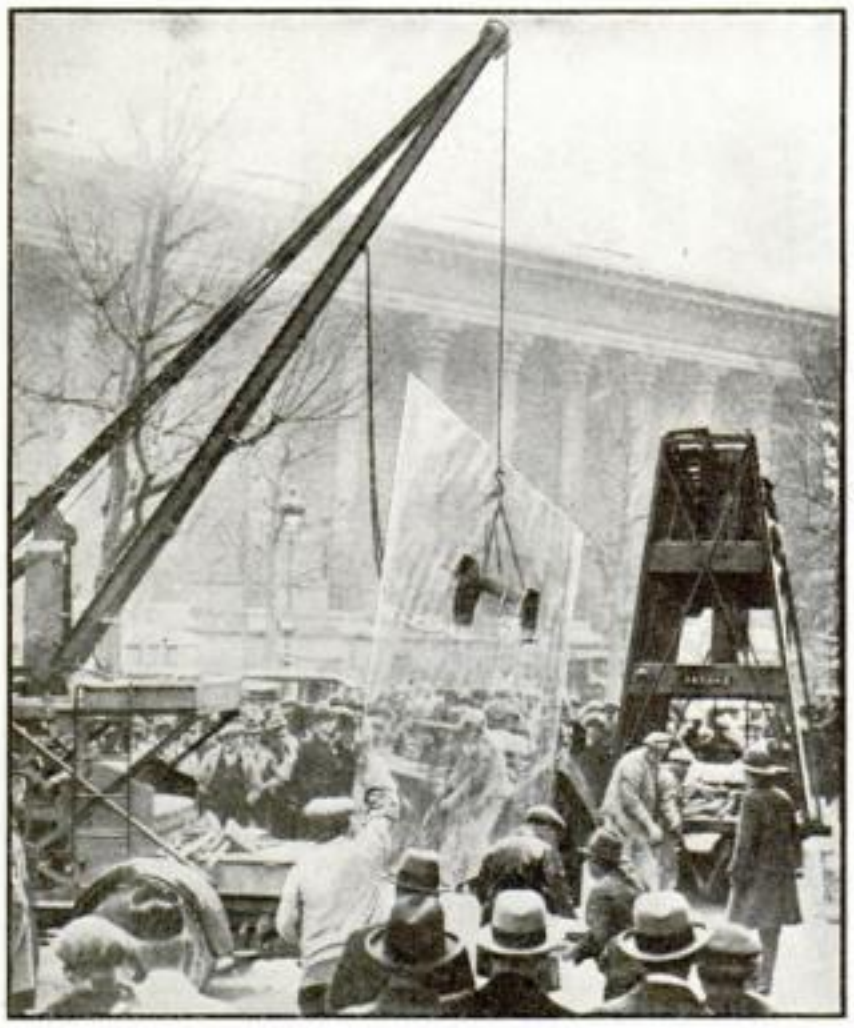
USE CITY STREET MODEL TO SHOW LIGHTING EFFECTS

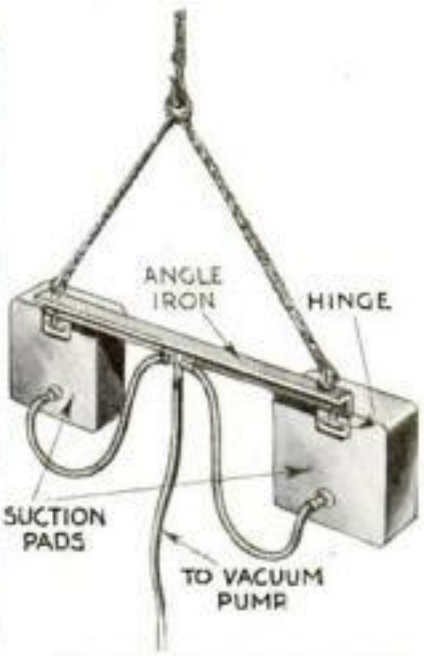
TO HELP municipal authorities solve their street lighting problems, an electric lamp manufacturers' association of Great Britain recently built a model street in which it is possible to demonstrate before town councilors the possibilities of different types of lighting standards. By pressing buttons and throwing switches more than a score of different types of lighting can be demonstrated, the unwanted lamps disappearing into small traps in the pavements.



A model street, in which everything is built to scale, including stores, theaters, and busses, is now being used in England to demonstrate the possibilities of various lighting standards

Suction Pads on Crane Lift Plate Glass





Drawing shows how suction pads grip plate glass. Left, crane and pads lift big pane

FRAGILE and costly panes of plate glass are now set in shop windows with a minimum of risk, through the use of a novel "suction crane." Tried out recently in Paris, France, this machine successfully installed a huge pane eighteen feet long and thirteen feet wide. Instead of gripping the glass with hooks or chains, the crane is provided with a pair of rubber suction pads linked to a vacuum pump. When the pump is started, the pads adhere tenaciously to the glass surface, lifting the pane without chipping or scratching.

BLIND PLAY CONTRACT WITH BRAILLE CARDS

SO BLIND persons can play contract bridge, special cards have been designed. Each card bears a combination of raised dots similar to Braille writing, to identify it. Note, in photo above, the peculiar manner in which a blind player holds cards so he can read them. When a card is played, the player calls it aloud so others may follow the game without touching each card. The score is kept in Braille, a small hand punch being used.

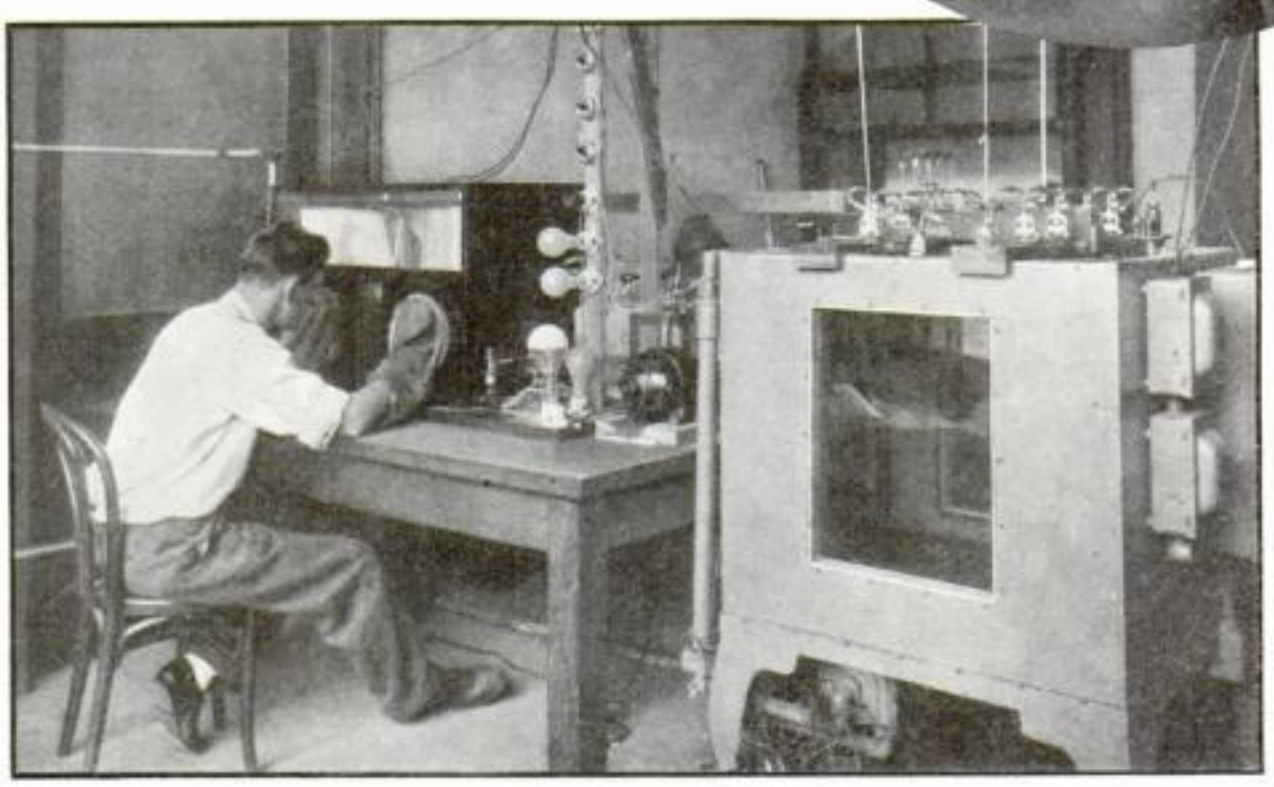
A light bulb set in this razor handle is turned on with button and throws its beams on face, as seen at left

LIGHT BULB IN RAZOR HANDLE

A NEW handle, interchangeable with the old one on several popular makes of safety razors, banishes the inconvenience of shaving in the dark or with insufficient illumination. It contains a flashlight bulb, a small battery, and a knurled switch. When the light is turned on, beams illuminate the user's face thoroughly, making each tiny hair clearly visible.

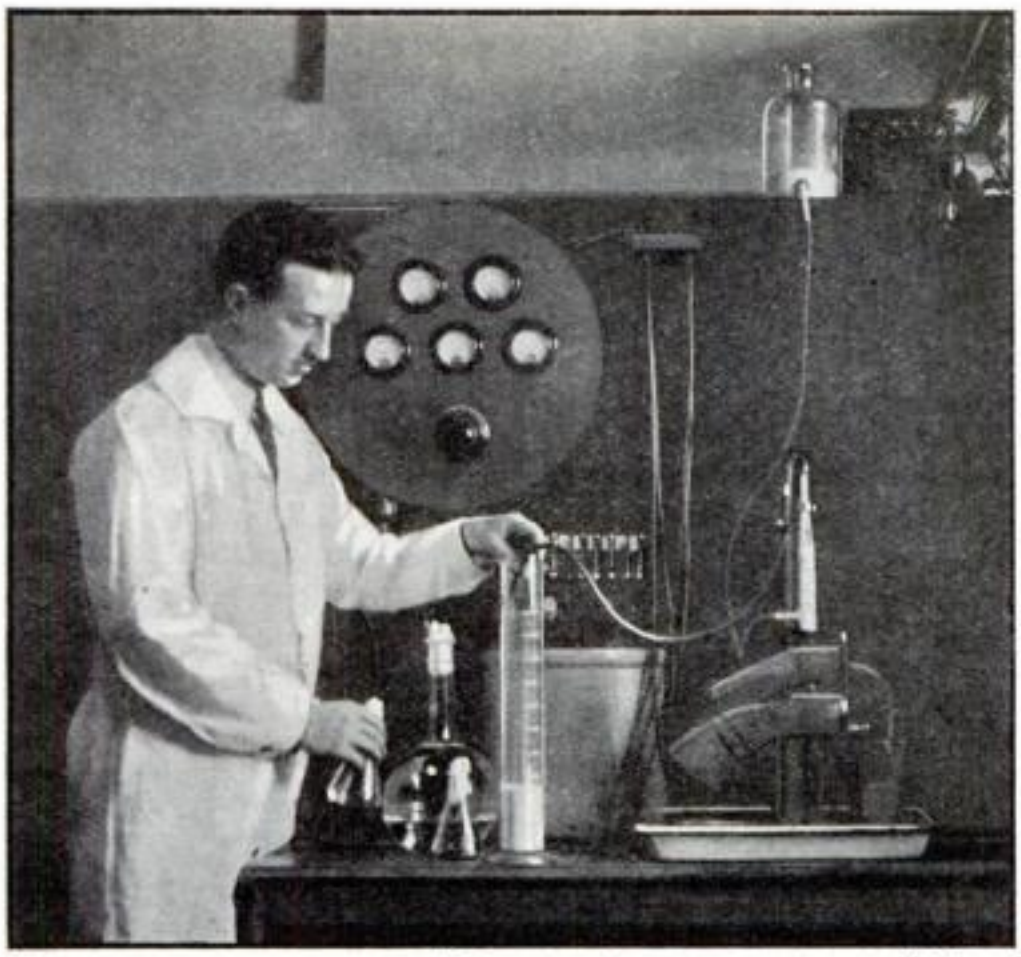
EVERLASTING PAPER SOUGHT BY GOVERNMENT

SUNLIGHT, humidity, and combustion gases from heating systems are the principle enemies of paper, according to tests conducted at the U. S. Bureau of Standards. Experimenters hope, by finding out why the paper of books, magazines, and newspapers deteriorates, to perfect an "eternal paper" on which records of historical importance may be printed. A number of the samples of paper used in the tests were manufactured at the Bureau of Standards' own model paper mill.



Above, testing the fact that light from a powerful arc lamp makes paper brittle. In order to keep paper from burning during this test an electric fan cools it

Samples of paper are hung in the cabinet before the operator, left, who studies the effect of sulphur dioxide on them. At his right is apparatus used in tests to regulate humidity



A vacuum tube generates an audio-frequency electric current in an oscillating circuit, giving off a shrill, high-pitched whistle that kills milk bacteria

WHISTLING PROVES TOO MUCH FOR BACTERIA AND THEY DIE OFF

WHISTLING bacteria to death is the latest way to sterilize milk as worked out by Dr. Leslie A. Chambers and Dr. Newton Gaines, members of the laboratory staff of Texas Christian University. With the aid of a 250-watt vacuum tube of the kind used in broadcast transmitters, they subject the milk to the shrill, high-pitched whistle of a 9,000-cycle note, obtained by generating an audio-frequency current in an oscillating circuit. The output of the tube is fed through the coils of a magnet to produce the desired vibrations in a nickel tube. The latter is connected to a rubber tube through which the milk flows at the rate of 100 gallons an hour. Although the milk is subjected to the vibration for only one second during its passage through the tube, the number of bacteria in the fluid is reduced by from eighty to ninety-nine percent.

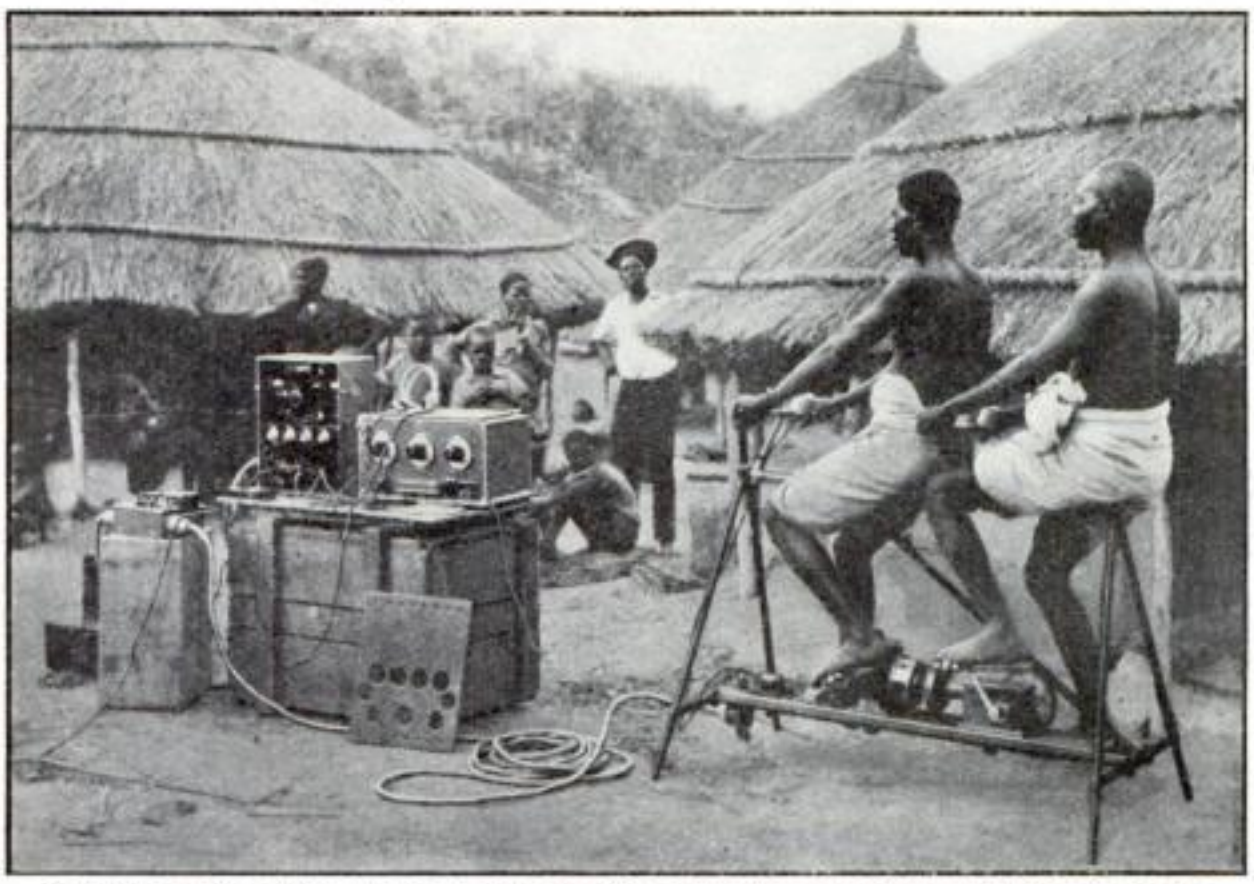
This new nightstick can be used to steady a policeman's hand so he can aim revolver like a rifle

NIGHTSTICK HELPS POLICE SHOOT

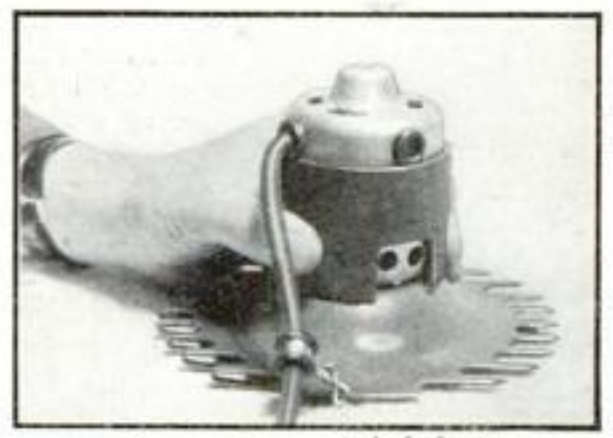
A POLICEMAN'S nightstick that can be used in an emergency to steady a revolver so it can be fired like a rifle has just been put on the market by an eastern manufacturer. A slot near the end of the stick receives a lug attached to the bottom of the revolver handle, so the weapon can be slipped into place or removed in an instant. By placing the other end of the stick to his shoulder, the user can steady the pistol and make distance shots with greater accuracy in chasing fleeing bandit cars. If the stick is jerked out of his grasp, the policeman still retains possession of the pistol, which is detached by a slight backward pull.

LEG POWER RUNS JUNGLE WIRELESS

BLACKS in Northern Rhodesia furnish the power to run the generator for wireless operations between stations separated by 500 miles of jungle. Mounted on a machine that resembles the frame of an old-fashioned tandem bicycle and pedaling at a moderate rate, they drive the generator by means of gearing. A flywheel ensures a steady output. Two handlebars, two saddles, and two sets of pedals replace an elaborate engine or water power. On each handlebar is a voltmeter with a red line on its face to indicate the correct speed. The natives are taught to keep their eyes on the needle and see that it stays on the red line. A packing box forms a crude table on which are an aircraft transmitter and a receiver.



Natives pedaling a bicycle-like machine in Africa generate power to send wireless messages



Above, new hedge cutter, electric powered, which can be held in one hand. Right, notched disk in which branches fit and revolving cutting blade

ELECTRIC HEDGE CUTTER HELD IN ONE HAND

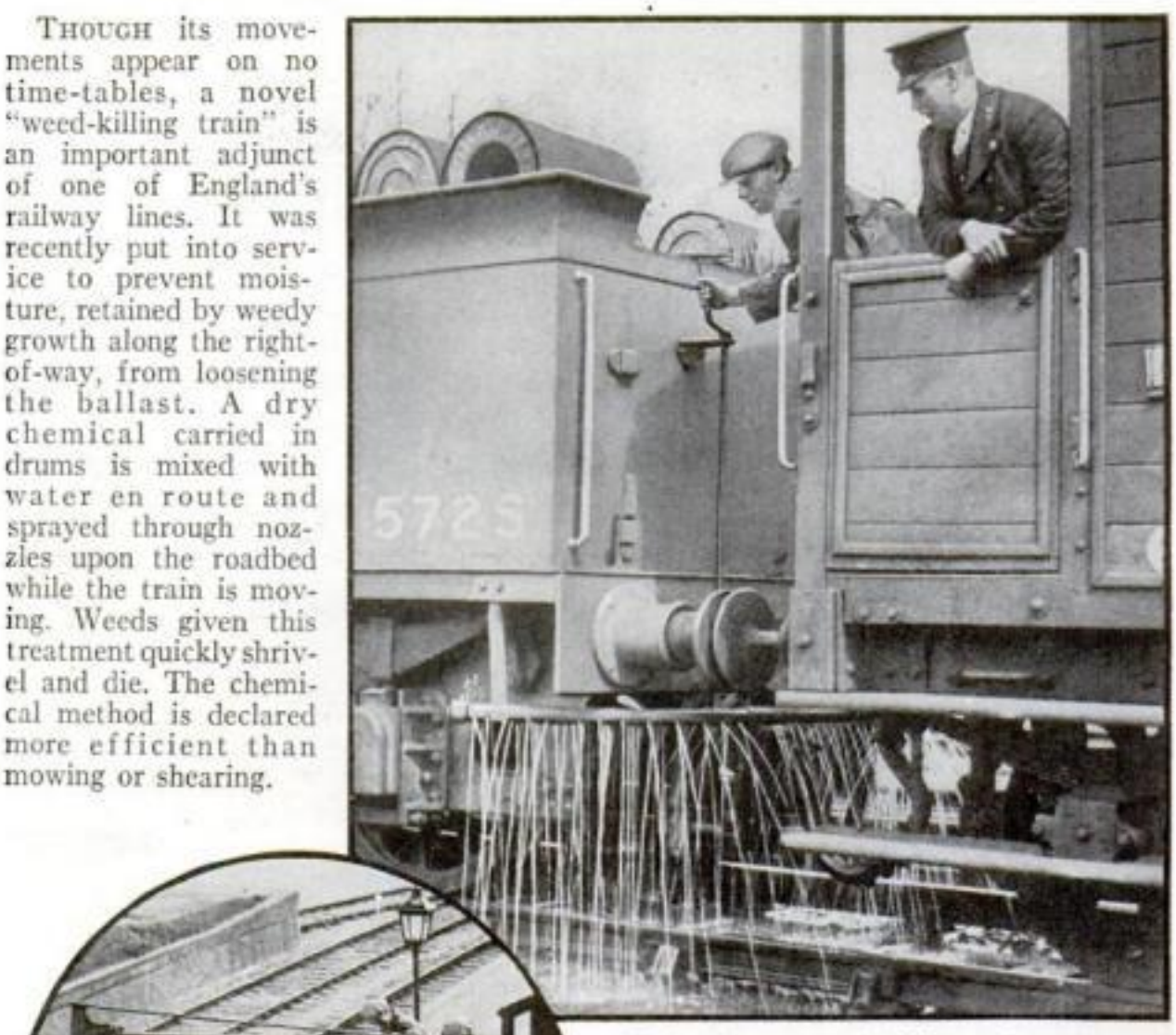
A HALF hour's work, according to the maker of a new compact electric cutter, will suffice to trim 100 feet of hedge. Devoid of a handle and held with one hand grasping the motor, it is able to get into corners and down between bushes. The branches are held in a circle of notches in a plate and a revolving blade makes a neat, clean cut. It is easy to bevel the edge of a hedge, or to cut rounded tops and corners, with the tool, and since nothing can get under the cutting blade, no ragged edges are left to mar the appearance of the hedge.

GLASS DIVING HELMET PERMITS CLEAR VIEW

IN MARKED contrast to the massive, hollow steel ball in which he descended a quarter of a mile below the surface of Bermuda waters last year is a light, portable glass helmet that William Beebe, noted explorer, took with him this summer on his third Bermuda trip. Its bell-jar top permits an unrestricted view in all directions, and is sufficient protection for descent to moderate depths; a weighted collar holds it down.

TRAIN CLEARS RAILROAD OF WEEDS

THOUGH its movements appear on no time-tables, a novel "weed-killing train" is an important adjunct of one of England's railway lines. It was recently put into service to prevent moisture, retained by weedy growth along the right-of-way, from loosening the ballast. A dry chemical carried in drums is mixed with water en route and sprayed through nozzles upon the roadbed while the train is moving. Weeds given this treatment quickly shrivel and die. The chemical method is declared more efficient than mowing or shearing.



England's new weed-killing train sprays a chemical solution over vegetable growth near track to destroy it so moisture can't gather

PASTE KEEPS WORKMEN FROM MARRING ENAMEL

A NEW paste in powder form has been developed especially to protect the glossy surface of bathtubs and washbowls from being marred or scratched while a building is being completed. When water is added and the mixture stirred, it forms a suitable adhesive for applying several thicknesses of newspaper to the enamel, forming a tough coating that will withstand considerable abuse. The paste is applied with an ordinary paintbrush. When the building is finished, the papers are soaked with water and peeled off.

Paste is spread over bathtub and paper stuck to it to prevent workmen damaging enamel

AMATEUR BUILDS POWERFUL TELESCOPE

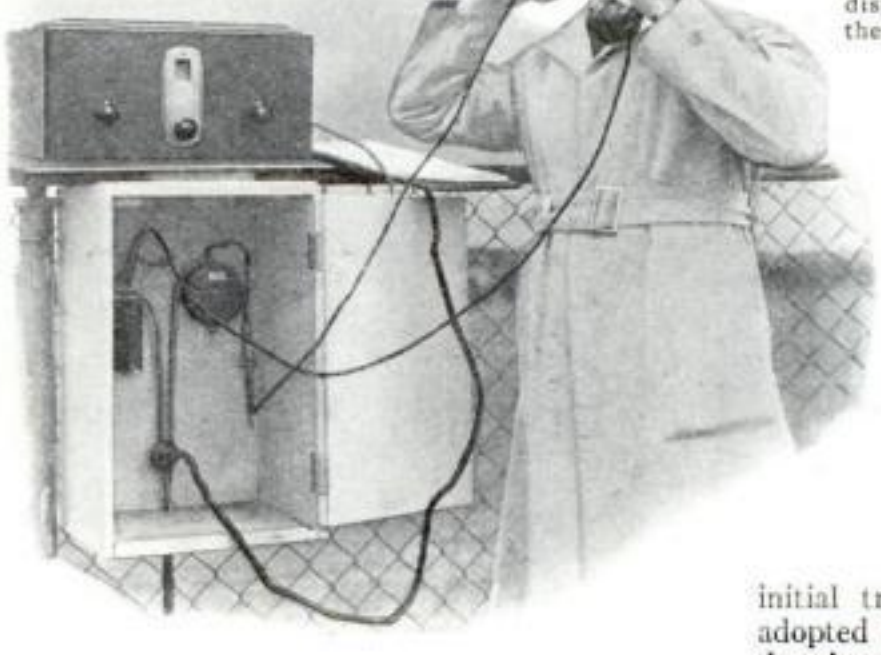
WHAT is believed to be one of the largest telescopes of amateur construction in America has been completed by N. P. Ridgeway, of Tacoma, Wash. Only the sixteen-inch Newtonian reflector, which gives an enlargement of 240 diameters, was purchased; the rest Ridgeway built for himself. Mounted in his private observatory, the instrument permits him virtually as close a view of the stars as many professional observers enjoy. Though the big telescope weighs 500 pounds, it is easily handled.

The photograph at left shows the builder applying the finishing touches in his back yard, preparatory to installing in his observatory.

Three-Way Radio Enables Pilot to Land Plane in Fog

While flying blind, this pilot is getting radio reports from field where he is to land

From the control tower the dispatcher also gives data to the pilot when motor is heard



Observer at edge of field tells pilot plane is overhead

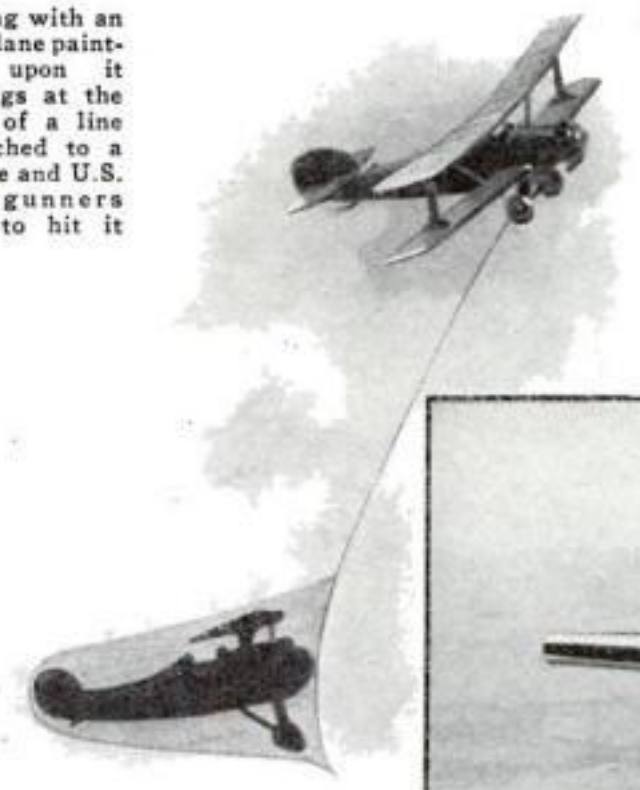
THOUGH fog may render near-by objects invisible, airplanes now loom out of the haze and roar to a safe landing with uncanny accuracy at a Burbank, Calif., airport. The secret of their ability to gage the distance to the earth is a three-way radio system recently put into operation, linking the pilot of the plane, an observer on the field, and the dispatcher in the airport control tower. While the pilot approaches the field, flying "blind" under the guidance of a long-range radio beacon, the observer stands at the edge of the airport listening for the plane's motor. When he hears the plane overhead, he notifies the pilot by radio telephone. A few seconds later, the dispatcher does the same as the airplane passes over the control tower. The airplane then circles back and repeats the maneuver. After this has been done several times, the pilot has a clear mental picture of the limits of the field, and he is able to dive through the fog blanket to a perfect landing without danger of overshooting the boundaries of the airport.

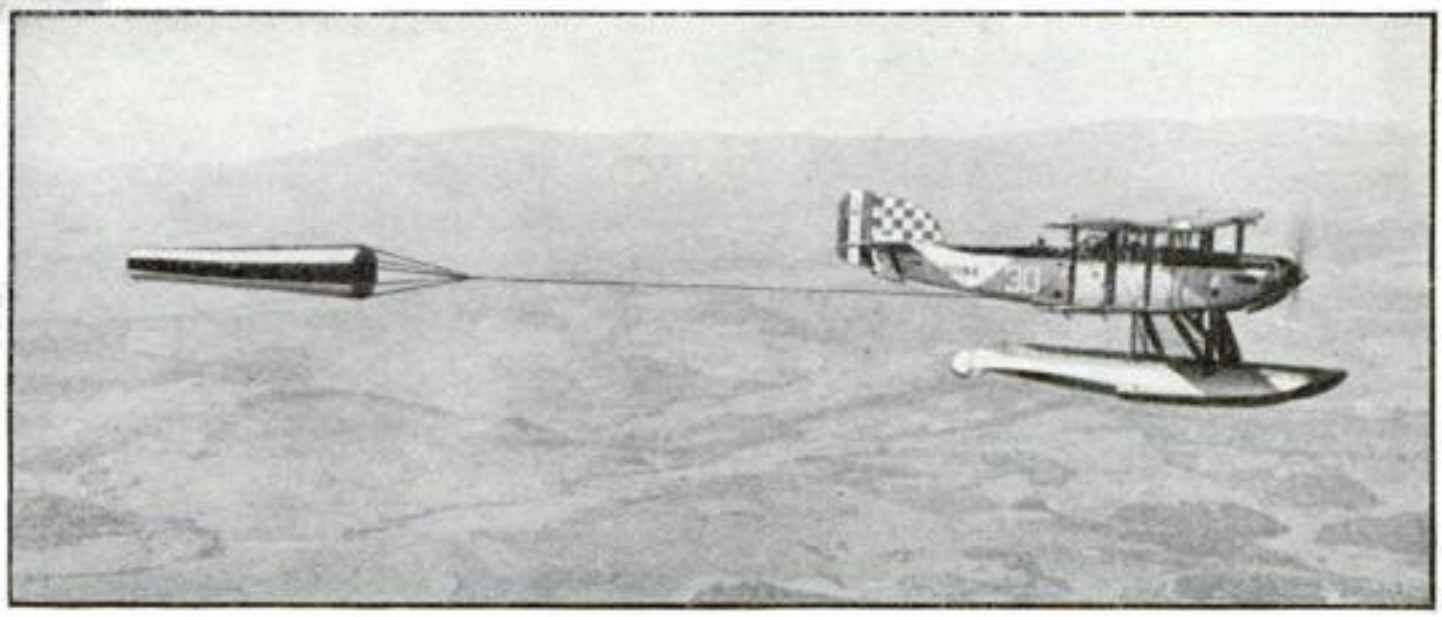
The system proved so successful in its initial try-outs that it has been adopted as standard practice at the airport whenever the visibility is poor.

FLYING TARGET TRAINS AIR FIGHTERS

AERIAL marksmen now improve their gunnery upon swift-moving targets towed through the air, of which two forms are illustrated in the striking photographs reproduced here. One of these, a brightly-painted fabric cone used by England's Royal Air Force, resembles the "wind socks" used to indicate the direction of the breeze at airports. It trails at the end of a long wire for machine gunners to shoot at. Even more realistic is a target upon which its German inventor has just been awarded a patent by the United States Patent Office. This transparent flag carries the outline of a plane; the gunner's accuracy is clearly shown by bullet holes.

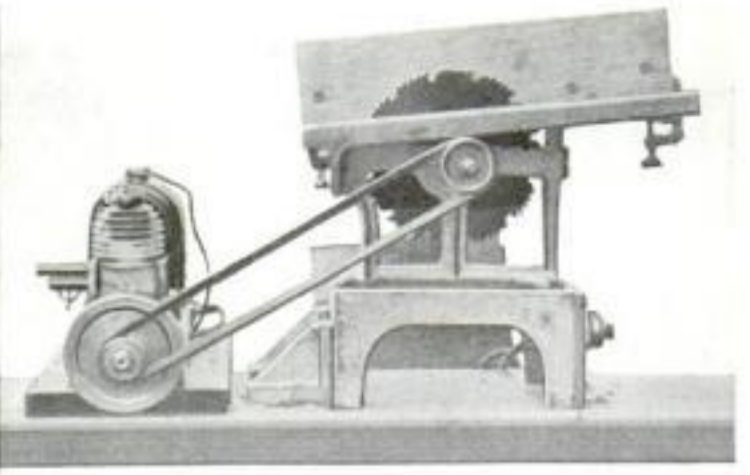
A flag with an airplane painted upon it swings at the end of a line attached to a plane and U.S. air gunners try to hit it





England uses wind sock trailed by a plane at end of wire as a target for her air marksmen

MIDGET GAS MOTOR WEIGHS LESS THAN FIVE POUNDS



This four-and-a-half-pound gasoline motor develops one horsepower and makes 4,000 revolutions a minute. It can be used to drive saws or drills or, as at left, it will run a child's play wagon and several trailers

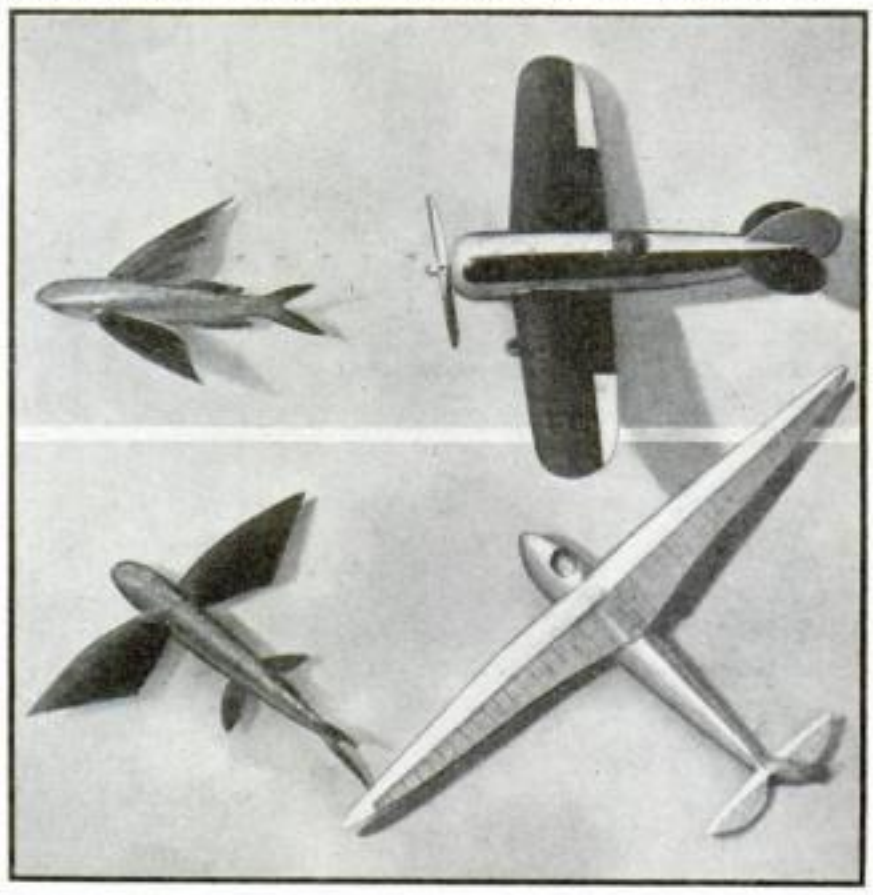
So SMALL that it resembles a toy, a new type of one-cylinder gasoline motor developed by a Pasadena, Calif., manufacturer is said to have real utility for work or play. Its power is sufficient to run a bicycle or a child's wagon, and when used in the latter capacity it will tow several trailers. Merry-go-rounds, circular saws, drill presses, and water pumps are among the other devices that it will operate. Although it weighs but four and a half pounds, the motor is said to develop one horsepower and makes 4,000 revolutions a minute. Gasoline mixed with lubricating oil serves as fuel.

STEEPLEJACK ON PULLEY CLEANS ANCIENT COLUMN

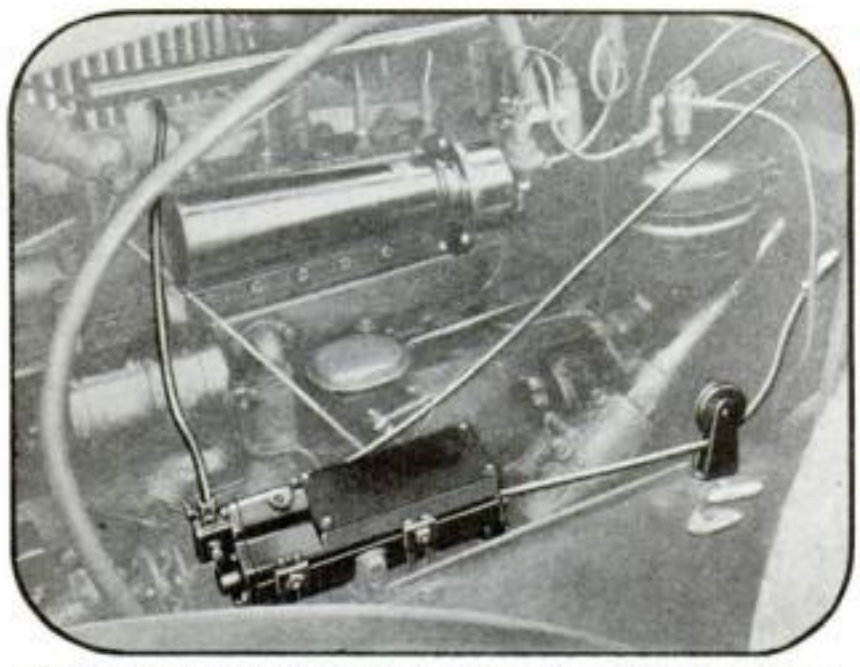
WHEN the carved exterior of a historic stone column at Rome, Italy, acquires a coat of dust and grime, it takes a steeplejack to clean it. The picture above shows him swinging from a pulley at the top, giving the ancient relic its spring cleaning. The column was erected in A. D. 98 by Emperor Trajan, who achieved a reputation as a builder of public works as well as a popular ruler and a brilliant leader of armies during his reign. Its carvings provide a priceless record of the life and customs of that period.

FISH USE GLIDER PRINCIPLE TO SOAR

PRINCIPLES of the airplane and the motorless glider are improved upon by Nature in the flying fish. How it is able to leap from the water to elude its enemies, and soar 150 feet or more before returning to its native element, is illustrated with stuffed flying fish, aircraft models, and aerodynamic diagrams in a new exhibit at the American Museum of Natural History, New York City. It starts its leap with wings extended; in the air, the wings, slanted toward the rear, are inclined toward each other in a "V." Since it can vary this angle, the flying fish is a more flexible flying machine than a craft with rigid wings.



Flying fish compared with an airplane and a glider in an exhibit recently prepared at the American Museum of Natural History



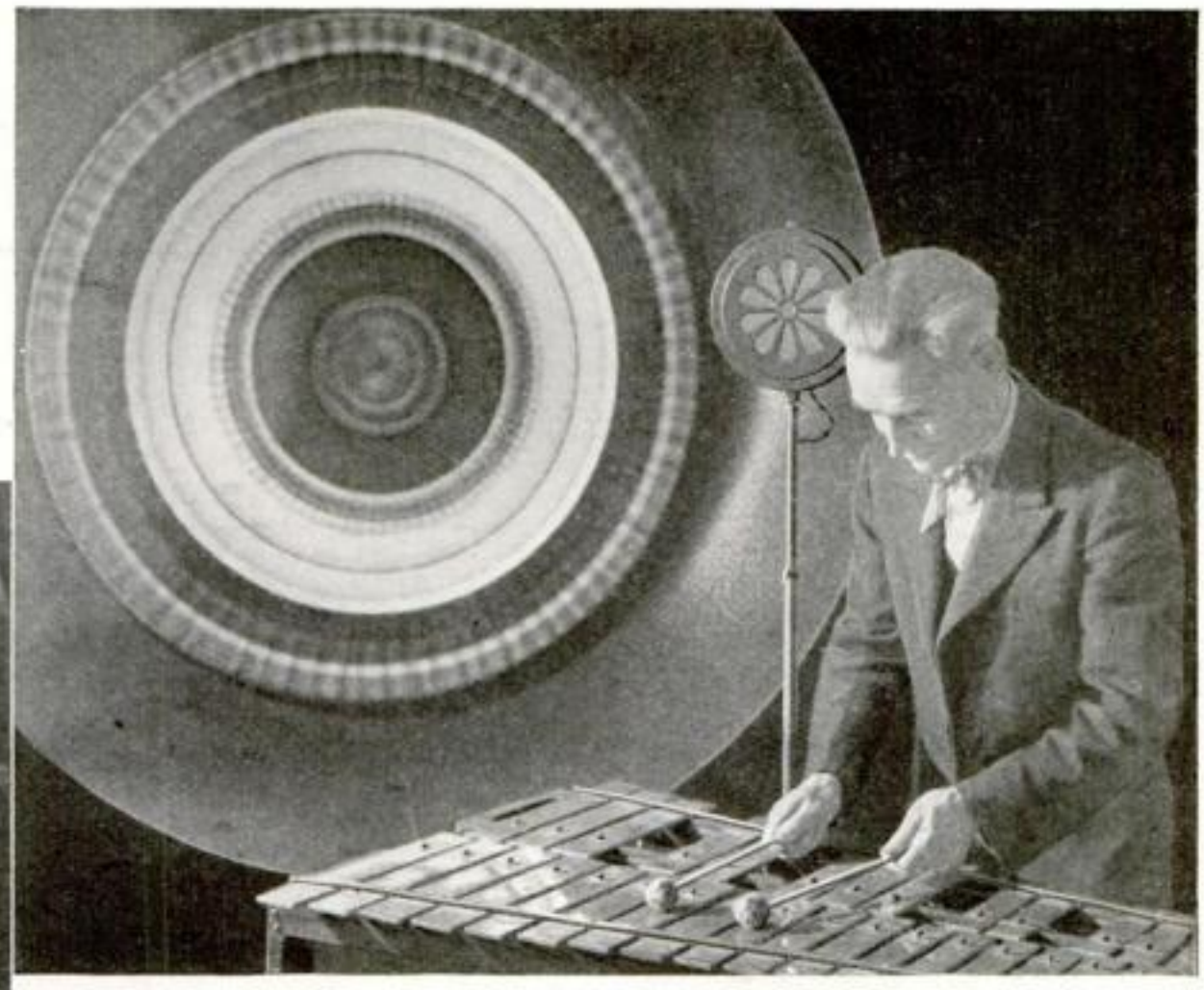
Picture shows new device installed beneath hood of car and connected with engine to operate the clutch when the accelerator is stepped on. Any car using it is free-wheeling when gas is off

FREE WHEELING FOR ANY CAR

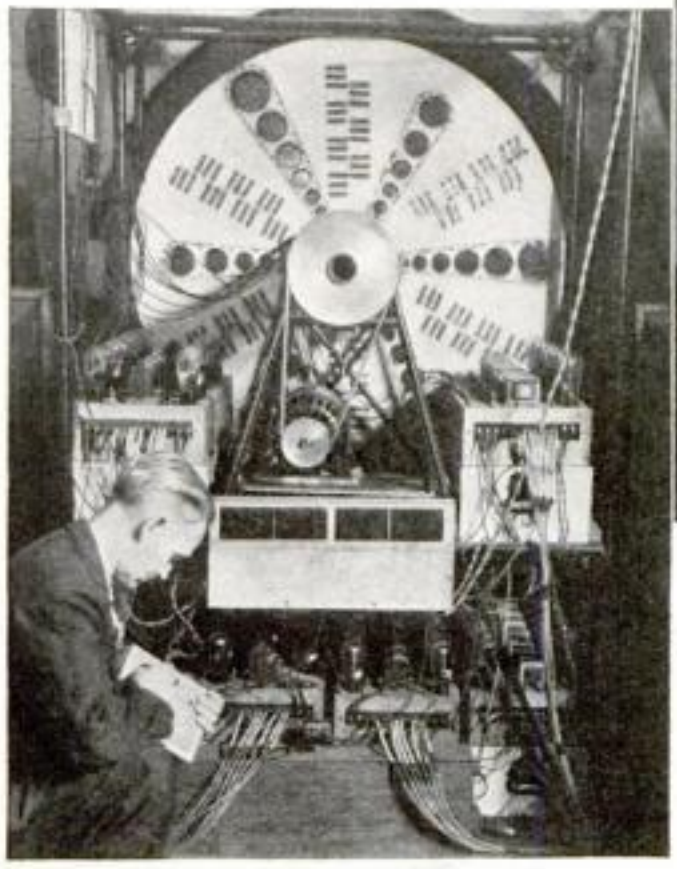
USE of the clutch pedal is eliminated by a new attachment that fits practically all kinds of cars, and makes them free-wheeling. When this device is installed beneath the hood, the motor is automatically in gear as soon as it is started, but the car does not move until the driver steps on the accelerator. The clutch is automatically released and reëngaged. The car becomes free-wheeling whenever pressure on the "gas" pedal is released.

Music Translated into Colored Lights by Vacuum Tubes

LATEST of many devices invented to translate musical tones into displays of colored light is a "colorphone" created by A. L. Smith, of Los Angeles, Calif. A huge disk revolves upon this machine, changing its rainbowlike hues in response to music picked up by a microphone. Each color illuminating the disk corresponds according to a predetermined scheme with one of eighty-eight tones of the musical scale. The heart of the apparatus contains forty-four vacuum tubes controlling the flashing of the proper lamps.



Upon the big disk in the background, flashing lights of many hues come and go as the inventor of the colorphone, Arthur L. Smith, strikes musical tones. Note microphone to pick up the music



Rear view of the colorphone which shows some of the forty-four vacuum tubes and other apparatus to turn music to colors

ENGINE TINY BUT FAST

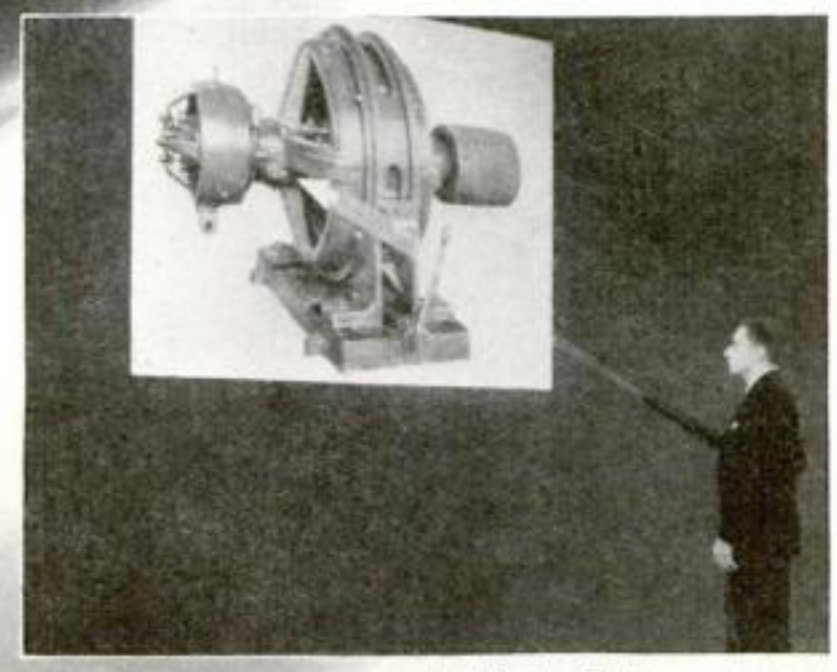
ONE of the world's smallest fire engines was recently demonstrated before fire department officials of London, England. It scoots at fifty miles an hour to the scene of the blaze, and carries sufficient apparatus to cope with any ordinary situation. The inventor declares that lightweight machines of this type can be built at a cost of less than $2,500 apiece. Fully loaded with equipment, the car weighs only 2,800 pounds. The engine was secretly built in a shed at Kingston-on-Thames.

MOTORISTS LOSE YEARS EACH DAY

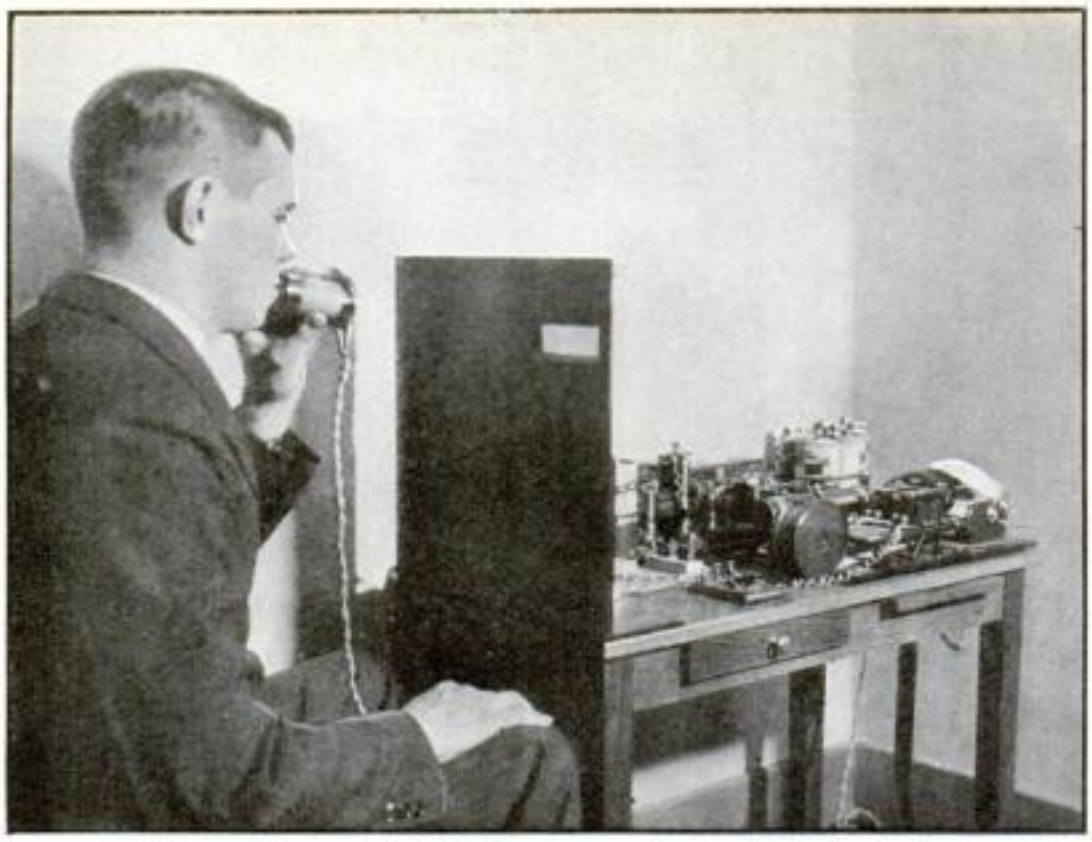
A STATISTICIAN of a national motor association has computed that drivers in American cities wait from twenty-seven to thirty-two years, each day, for the green traffic light. Staggered lights, permitting continuous driving, would cut this total of waiting time, he suggests, though he finds four-fifths of it is necessary.

LIGHT RAY IS LECTURER'S WAND

AN ELECTRIC pointer that shoots an illuminated arrow at a screen now replaces the old-fashioned wooden pointer used in illustrated lectures. In the hands of a speaker, it enables him to point out important features of a picture without wielding a cumbersome rod. The aluminum device contains a 125-watt lamp, a slide bearing the outline of an arrow, and lenses for projecting the image. One thumb switch flashes on the light, while another notifies the operator when to change slides.

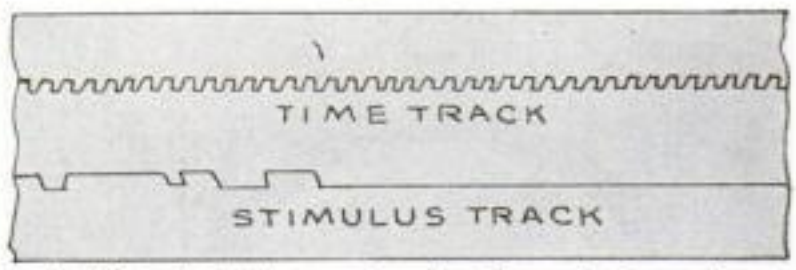


At left, the light ray pointer in which is an objective lens, a condensing lens, a small slide with an arrow on it, and a 125-watt lamp. When a switch on the handle is pressed, the arrow of light is thrown to any desired point, as is illustrated above



SPEED AT WHICH BRAIN WORKS TIMED IN SPLIT SECOND

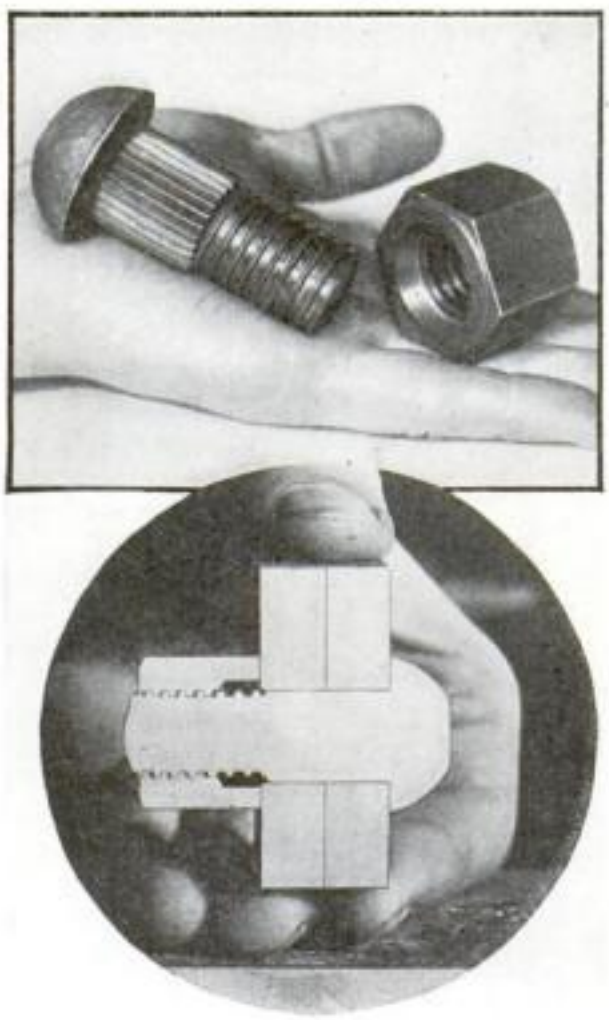
SIGHT readers can now learn how long it takes them to speak a word after they see it, with a device worked out by Miles A. Tinker, professor of psychology at the University of Minnesota. As the subject repeats the word, air pressure vibrates a rubber membrane which in turn opens and closes a circuit. A stimulus marker, thus actuated, traces an irregular line on waxed paper while a time marker is tracing a line broken at intervals of a tenth of a second. A comparison of the lines shows the time required to see and speak the word.



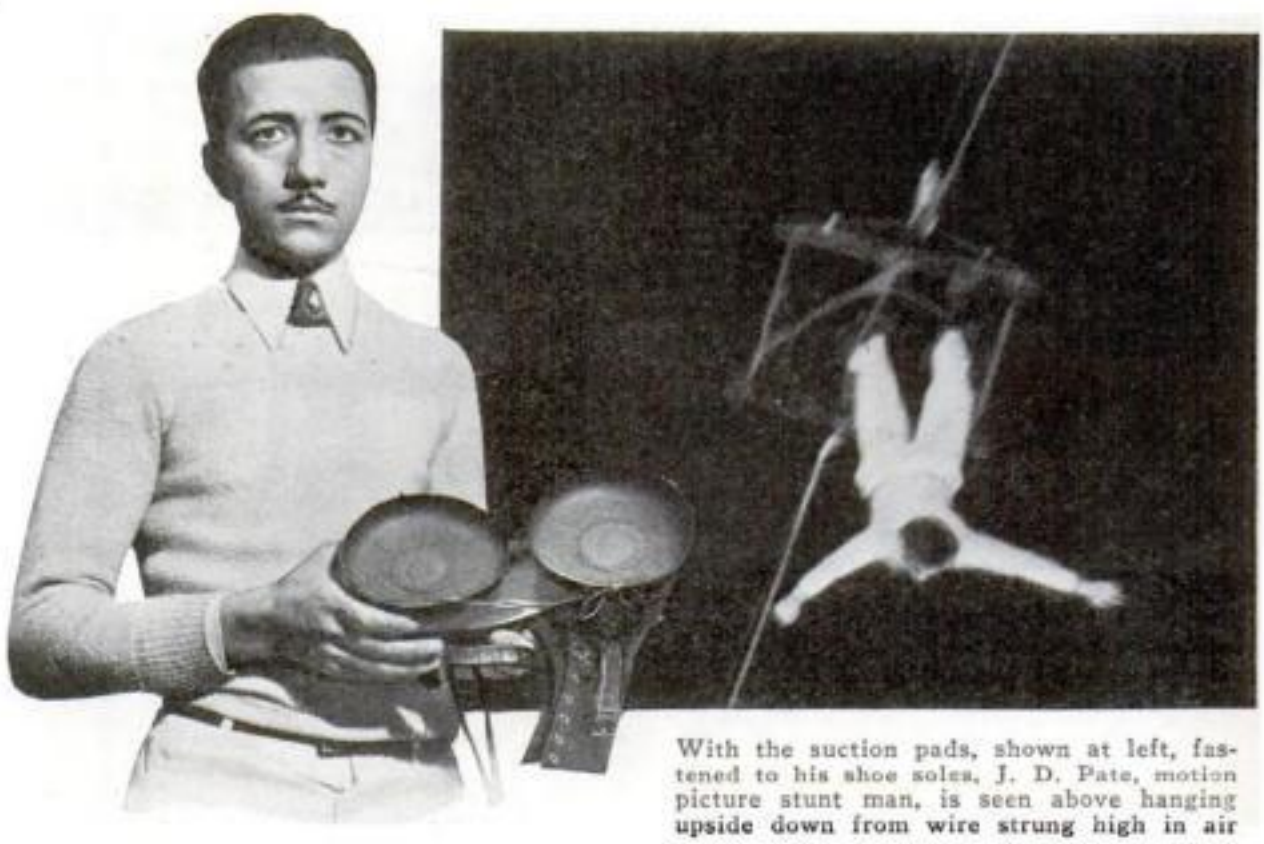
At left, electrical apparatus that times brain reactions and, above, the split-second time line with the line broken by the reader's voice below it. Comparison gives record

NEW BOLT AND NUT TO REPLACE HOT RIVET

ENGINEERING laboratory workers at Columbia University, New York, recently tested successfully a new invention designed to silence the rivet gun and make structural steel stronger. This "rivet bolt," driven home with a five-pound hammer, is held in place with a self-locking nut turned with an ordinary wrench. Specially designed threads grip the nut so vibration cannot loosen it. Cold when put in place, the bolt does not shrink and permit play in the plates, a condition ascribed to the hot rivets. Splines on the bolt's shank insure a tight fit in the hole drilled for it. There is a slight noise in inserting the new bolts, but ninety-nine percent is abated.



This bolt and nut, grooved and specially threaded, are designed to replace rivet in steel work. In circle, holding plates snugly



With the suction pads, shown at left, fastened to his shoe soles, J. D. Pate, motion picture stunt man, is seen above hanging upside down from wire strung high in air

STUNT MAN IN AIR WALKS UPSIDE DOWN

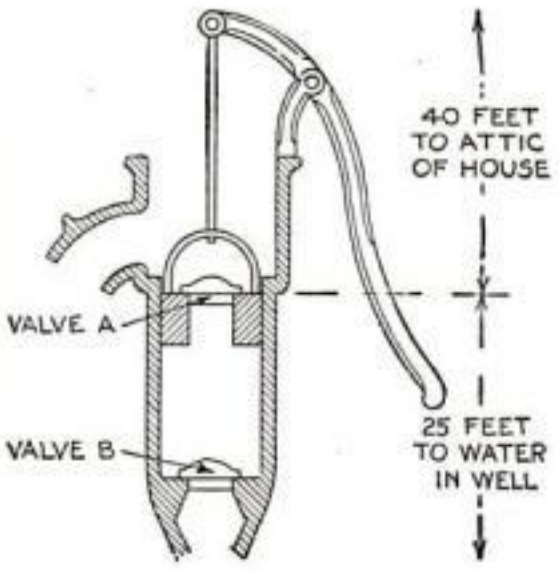
HANGING by the soles of his feet 390 feet in the air was the latest thriller successfully demonstrated by J. D. Pate, motion picture stunt man. Giant suction cups, fastened to his shoe soles, made him a literal "human fly" and held him while he was drawn between two high Los Angeles, Calif., buildings. His exhibition was given at night and powerful searchlights played on his dangling form.

AIRPORT SHEEP KEEP FIELD IN SHAPE

A Berlin airport is using a herd of sheep to crop vegetation and keep field fit

MANAGERS of the Tempelhofer airport, Berlin, Germany, have added a thousand sheep to the airport's possessions and turned them out to graze on the field. Grass and weeds have small chance to grow tall enough to interfere with planes when a thousand sheep attack a limited area. The officials say the sheep will keep the field in shape at less cost than a corps of men could do the job.

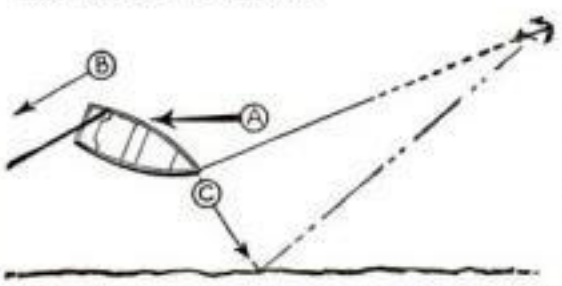
Can You Invent It?



A MAN living where there is no waterworks wants to have piped water on the upper floor of his two-story house. He has, in the kitchen, a pump of the type shown above. Its spout delivers water twenty-five feet above the level of the water in the well. As the piston rises, valve *A* closes, valve *B* opens, and the water rushes up into the chamber; when the piston starts to descend, valve *A* opens, valve *B* closes, and the water runs out of the spout. This simple suction pump will raise water about twenty-five feet, since its action depends upon the pressure of the atmosphere to fill the vacuum in the pipe and atmospheric pressure will not support a column of water higher than thirty feet. Can you invent a type of pump that will work with a handle, have only two valves, and enable the man to pump water into a tank in the attic of his house, which is forty feet above the pump, and therefore sixty-five feet above the level of the water in the well?

* * * *

Here is the answer to last month's problem. The man adrift in a boat having only one oar could save himself from going over the falls by the method shown in the diagram. First he throws over the anchor allowing the entire 200 feet of rope to run out. This holds the boat stationary in the current. Then, by using his one oar as a rudder at the stern, he can turn the boat's nose until the current acts more strongly on the left side. The current will land it at the bank.



This diagram shows how anchor will hold boat while one oar swings it to the shore

MOTORBIKE RUNS AS TIRE IS CHANGED

SOMETHING brand-new in thrills was furnished spectators at a recent motorcycle tournament at Tidworth, England—a demonstration of the hazardous feat of changing a tire at fifty miles an hour. The stunt was performed by a driver and passenger in a cycle equipped with a side car. The driver, throwing his weight to the right, tilted the car clear of the ground and held it in that position while he traveled nearly a mile a minute. The mechanic, leaning over the edge of the car, removed the wheel, tossed it away, and substituted a new one.

Changing a tire while whirling along at fifty miles an hour

PLATFORM ON AUTO FOR TROLLEY WORK

IN BRUSSELS, Belgium, workmen repair overhead trolley wires at their leisure. On top of the big company trucks is a platform, large enough to hold the workman and his tools, that can be raised to a position directly beneath the wires. The platform, operated by the truck's engine, takes the place of a movable scaffold and goes quickly to the point of accident, and is readily elevated so work is done safely and conveniently. When lowered in place on the truck's top, the platform does not interfere with clearance nor hamper the movements of the machine. Transit officials say that it interrupts the regular street traffic less than any means formerly used and at the same time greatly facilitates overhead repair work.

NEW PROPS HOLD LADDERS FOR SCAFFOLD

RECENTLY perfected props will turn any ladder into a support for a scaffold or transform it into an ordinary stepladder. A U-shaped metal crosspiece hinges to the top of the ladder and to this is bolted the swinging wooden prop, the foot of which is securely braced to prevent slipping. The crosspiece extending against the building holds the ladder and prevents swaying. The inventor says the attachment facilitates work by reducing the number of ladder shiftings necessary to reach the entire wall area. The props can be used with two or more ladders to form a support for a scaffold.

To a crosspiece hinged to the top of an ordinary ladder, a wooden prop is bolted and, with its lower end braced against the ground, it holds the ladder in any desired position.

Novel Appliances for the HOME

KEEPS ALL FOOD HOT. The food carrier illustrated above slides on a track from kitchen range to dining table and the foods are kept hot by electric unit

TILE FOR ANY WALL. Composition tiles that are cemented to a wall of plaster, wood, iron, or wall board are now procurable. Cement is spread on the wall and the tiles are then pressed on one at a time. They can be cut to fit odd places or bent around corners

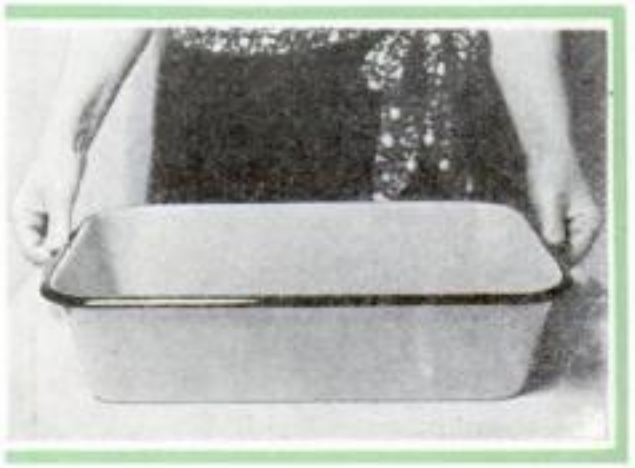
TABLE FOR SMALL ROOM. The console at right is really a dining room table at which six persons can be seated. To use as a table, it is pulled from wall and the backdrop raised as seen in picture above. The six chairs fit the table snugly when forming front of console

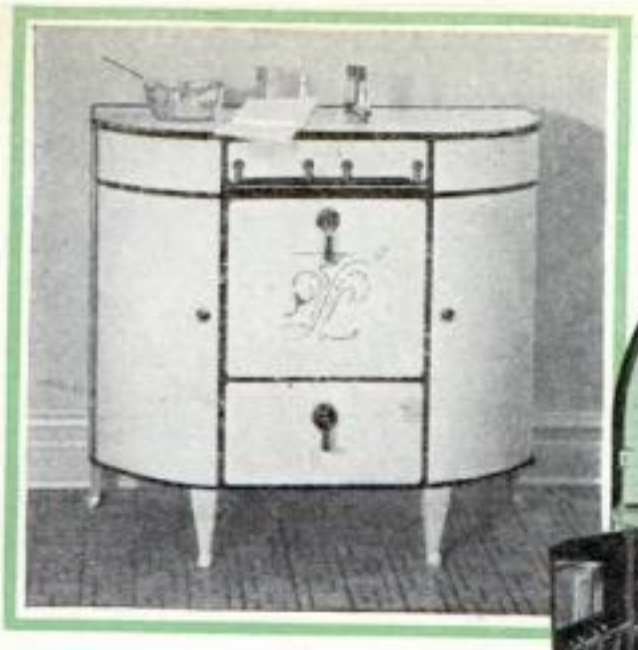
AUTOMATIC WASHER. The two halves of the device seen above are placed in the bottom of clothes boiler and set up a circulation that keeps soapy water moving

NO SCALDED HANDS. A rubber suction cup on this new tool saves the housewife's hands in picking dishes out of hot water. The cup is pressed against the surface of the dish and is then lifted up out of the water

PROTECTS YOUR FINGERS. This new type vegetable grater has a metal flap on which the fingers rest, so that there is no danger of injuring them with an unlucky slip, while the vegetable is thoroughly grated

DOUBLE-DUTY PAN. Built to fit the kitchen sink, this oblong dishpan is expected to lessen breakage. It can roast meats or it will hold four loaves of bread for baking





LOOKS LIKE VANITY TABLE. The gas range pictured above, and at the right, is a decorative piece of furniture, though its attractive appearance does not detract from its practical value. The folding top can be lowered over its four burners to serve as a kitchen table and there are cupboards at the sides for dishes

INK BAROMETER. Somewhat resembling a glass teapot, this barometer predicts weather conditions by rise and fall of ink in pot's spout

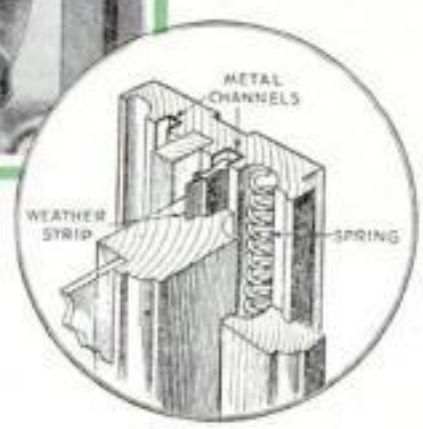
SOAP CAN'T SLIP AWAY. This nonskid soap is held by a loop that is attached to it

MILK BOTTLE ON TABLE. This holder clamps around a milk bottle and turns it into a pitcher easily picked up and from which milk can be poured without waste

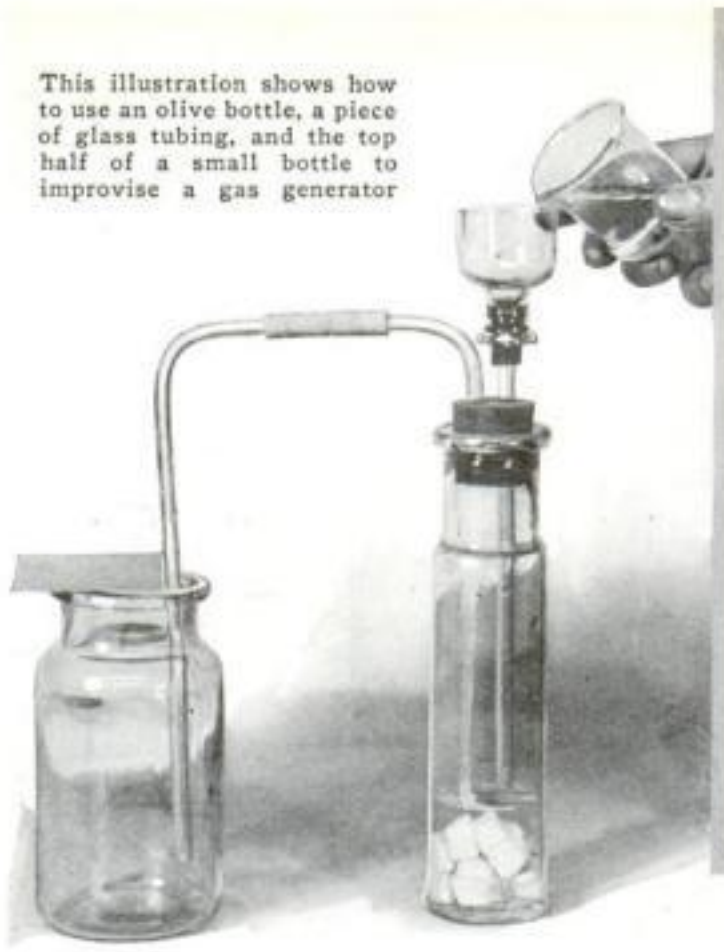
BUMPER FOR PERCOLATOR TOP. To guard the glass percolator top, this aluminum cap is made to fit over it. It also serves as a coffee measure

HOLDS THE PAIL. The uncomfortable task of holding a pail between the knees is done away with by the use of this pail-holding device. It consists of a pair of metal plates that attach to rim of pail while extensions rest across thighs

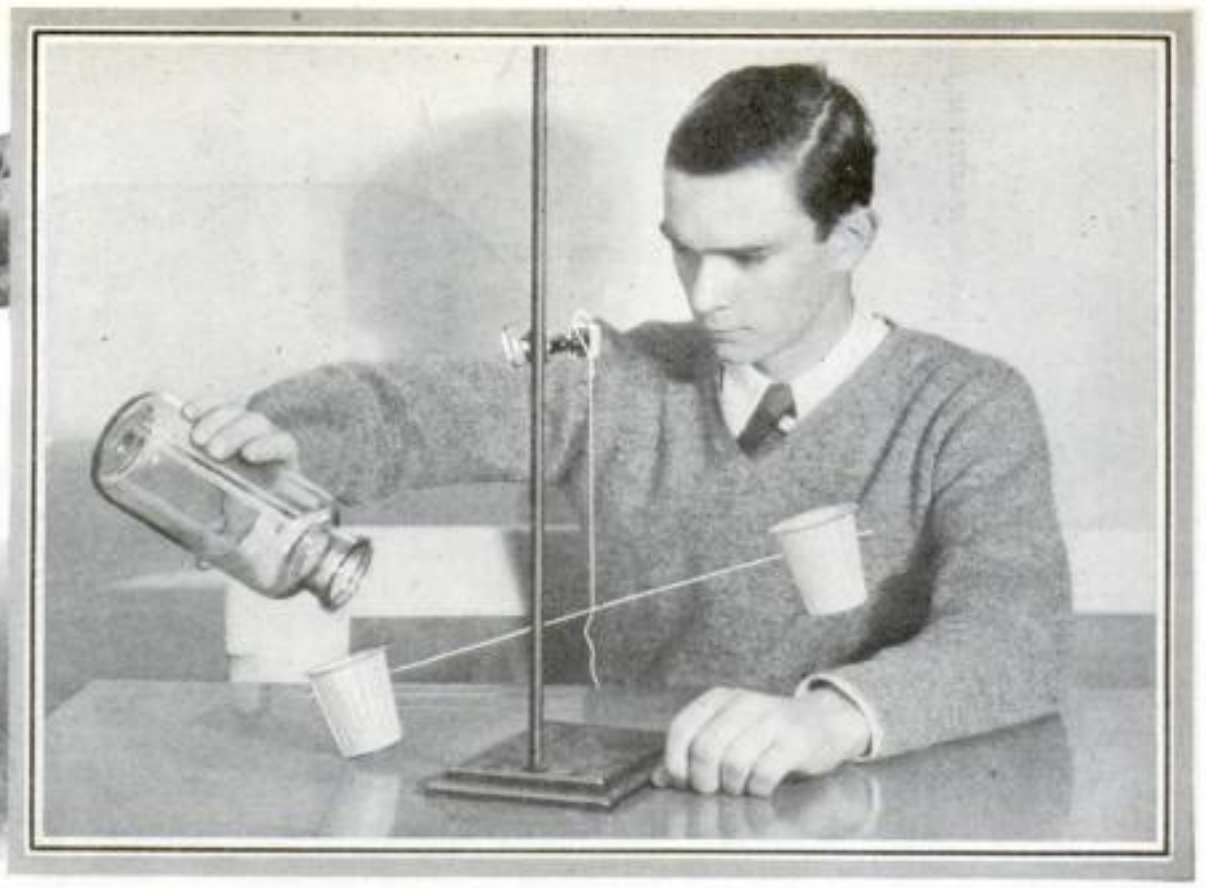
BOILED EGG WHISTLES. In the cover of this egg cooker is a timing device that regulates the cooking of eggs and at expiration of chosen time a whistle sounds warning that eggs are done



SEALS WINDOWS. Fitting so snugly that cold winds are kept out, weather strip is built into this new window. It has no sash cords or weights, and is held open by concealed springs in the frame. Drawing gives interior construction



This illustration shows how to use an olive bottle, a piece of glass tubing, and the top half of a small bottle to improvise a gas generator



This simple balance shows that carbon dioxide is heavier than air. Pour the gas into one of the cups, and the cup will at once sink

Carbon Dioxide *easy to make in* HOME LABORATORY

A bit of wet cotton attached to the cork absorbs gas from the bottle and creates a vacuum that will draw water out of glass

By R*aymond* B. W*ailes*

LAST month I described how, with a simple "gas works" and bits of marble, you can produce carbon dioxide gas. This is a colorless, odorless, and tasteless gas, yet human life, animal life, and even plant life could not exist without it. All muscular energy and body heat come from the manufacture within our tissues of carbon dioxide and water. We are engines burning hydrocarbon compounds. Every breath we exhale carries off the resulting water vapor and carbon dioxide gas.

Plants reverse the process. They absorb carbon dioxide from the air, and by some mysterious chemical process not fully understood, tear apart the carbon and oxygen. They reunite the carbon with hydrogen to form the hydrocarbons of which they are mainly composed, and breathe out the oxygen through their pores just as we breathe out carbon dioxide through our noses.

You can produce any desired quantity of carbon dioxide gas by burning wood or coal. However, it is not so easy to collect the gas thus produced and free it from the other products of combustion.

A simple carbon dioxide gas generator can be made from an olive bottle. First, fit it with a cork through which two holes have been bored. Through one, push a piece of glass tube long enough to reach nearly to the bottom of the bottle. Fit an ell-shaped tube to the other.

Some form of funnel is needed on the upper end of the long tube so that liquids can be poured into it. Cutting a small round bottle in half by methods previously described (P. S. M., Feb. '32, p. 69) will allow you to use the inverted upper portion of the bottle as a funnel. Fit it by means of a bored cork or a short piece of rubber tubing acting as a bushing as shown in upper left illustration on this page.

Save the lower half of the bottle. It will come in handy to mix chemicals and make small quantities of solutions. The sharp edge can be removed by rubbing with emery cloth.

Carbon dioxide gas can be made in the gas generating bottle by placing marble chips, old pieces of mortar, or baking soda (sodium bicarbonate) in the bottom of the bottle and pouring an acid into it through the funnel. Weak hydrochloric acid is suitable. Mix one part of the acid with four parts of water.

The acid reacts with the substance in the bottle to form a salt which stays in solution, and carbon dioxide gas which comes out of the bent tube. If baking soda is placed in the bottle, common vinegar can be substituted for the acid. Vinegar is a weak acid solution containing about five percent of acetic acid. A large amount of acid is not required nor is heat necessary.

The carbon dioxide gas can be collected and stored in bottles for future use just as you would keep water, sugar, or any other substance. A suitable way to handle the gas is to connect the ell tube with another bent tube that projects to the bottom of the storage bottle. If the air in the room is quiet, the gas is so heavy that it will fill the bottle, starting at the bottom, and in doing so force out the air. A sheet of cardboard placed across the mouth of the bottle will prevent air currents from blowing the gas out of the bottle. If you wish to store the gas for any length of time, carefully cork the bottle. Label the bottle, as there would otherwise be nothing to distinguish it from one apparently empty. Carbon dioxide gas is invisible.

One of the important characteristics of carbon dioxide gas is that it can extinguish a fire. A lighted candle lowered into a bottle filled with the gas will go out at once. The action is purely mechanical, not chemical. The candle, or any other substance, burns because oxygen from the surrounding air is constantly uniting with the burning substance. Carbon dioxide gas flowing around the material shuts off the air and so smothers the flame as effectively as would water.

A better way to show the fire-extinguish-

HERE Are a Number of Fascinating Experiments with a Highly Important Gas That You Chemists Can Perform with Easily Built Apparatus

With limewater in the bottle and a funnel, as shown, to collect the gas, you can prove that carbon dioxide is one of the gases given off by the burning candle

ing properties of the gas, and also its great weight, is to pour the gas from its container onto the flame just like water. The flame will be snuffed out. If ignited again, the experiment can be repeated five or ten times.

When the air in the room is still, the gas can be poured from a considerable height, which makes a more effective demonstration, although it is more wasteful of gas. Another variation of this experiment is to pour the gas onto the flame through an inclined mailing tube.

Of course a gas would not have to be much heavier than air to flow downward when released. A more striking demonstration of its relatively great weight can be given by constructing a simple but sensitive balance out of a light, stiff piece of wire, two paper drinking cups, and some thread.

Stick the ends of the wire through the paper cups at points a little above their centers of gravity. Then suspend the wire at its center with a piece of thread. After you have adjusted the position of the thread till the cups balance at about the same level, pour carbon dioxide gas into one of the cups, being careful not to touch the cup with the bottle. The cup will at once go down because of the weight of the gas.

The huge soft drink industry that turns out millions of bottles of soda pop depends entirely on one property of carbon dioxide gas. That property is its great solubility in water. If heavy pressure is applied, a large quantity of the gas will dissolve in water whether plain or mixed with syrups and coloring matter. Carbonated water results.

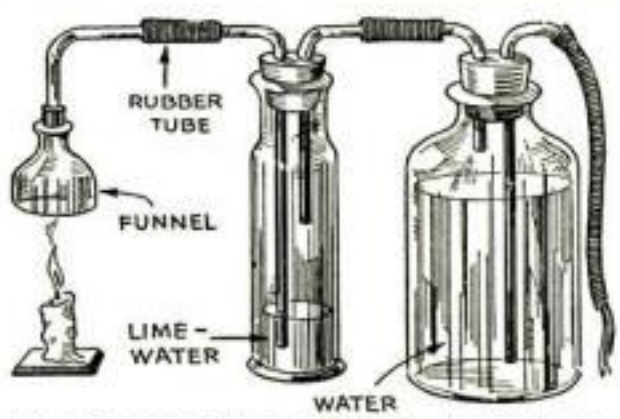
Even without pressure, carbon dioxide gas dissolves in water, although not in sufficient quantity to produce the bubbles that are typical of carbonated drinks.

There is no visible evidence that carbon dioxide gas is dissolving in water when you allow the gas to bubble up through the liquid. However, there is a simple test you can make in your laboratory to prove that it does so.

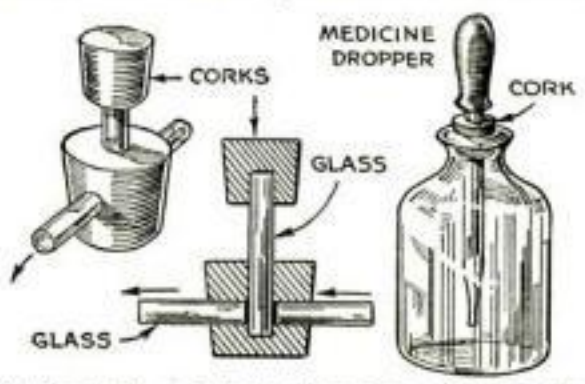
Fit a bottle with a one-hole cork carrying a bent tube. Attach a second bent tube as shown in the picture in circle on page 60. Place the end of the second tube in a small container filled with water. Next, fill the bottle with carbon dioxide gas. Now remove the cork and attach to it, by means of a pin or tack, a bit of moistened cloth or cotton waste. Replace the cork in the bottle of gas.

In a short time you will notice that water will rise in the tube stuck into the small container of water. This indicates that the carbon dioxide gas is dissolving in the water on the cloth and is thus producing a slight vacuum. If the cloth is dampened with a weak alkali solution such as lye water, the absorption of the gas will be much more rapid so that water may even be drawn through the tube into the gas bottle.

If you blow steadily through a tube into a bottle containing limewater, the carbon dioxide in your breath will soon give the water a cloudy look



This drawing shows, in detail, the hook-up used in passing carbon dioxide through a bottle of limewater by means of a vacuum



At the left, a simple gas valve. Pulling up cork allows flow of gas. At right, the manner of fitting a medicine dropper through a cork for use in dropping a reagent into bottle

Although carbon dioxide gas is most conveniently made in the home laboratory by the marble chips-acid method already described, it also is interesting to study some ways of producing it by burning.

All substances containing carbon, such as candle wax, coal, sugar, and wood, produce the gas when they burn. It is easy to become a home analytical chemist and detect the presence of carbon dioxide in the gases produced when substances burn.

The drawing at upper left of this page shows in diagrammatic form the apparatus you will need to detect the carbon dioxide gas coming from a small flame. After washing out your gas generator, place a small amount of limewater in the bottom of the bottle. Substitute a bent piece of tubing and an ell for the straight piece to which the funnel was attached. Then fit the funnel in the inverted position. Pipe to a larger bottle with a rubber tube outlet as shown. After the larger bottle is filled with water and the candle is lighted, start water siphoning out of the rubber tubing and place the candle under the inverted funnel.

The water running out of the large bottle will create a vacuum and the gases from the burning candle will be drawn into the funnel and forced to bubble through the limewater on their way into the large bottle.

You will soon notice that the limewater is becoming cloudy. This indicates that carbon dioxide gas has passed into the limewater.

Keep in mind this method of creating a vacuum. It will prove useful in many other laboratory tests.

Of course the test also can be carried out without the water bottle vacuum pump by closing your lips over the outlet pipe of the bottle containing the limewater and sucking the gas through.

This same set-up can be used to prove that the breath you exhale contains carbon dioxide gas. Remove the inverted funnel and blow steadily into the tube so that your breath bubbles up through the limewater. It will show the white precipitate.

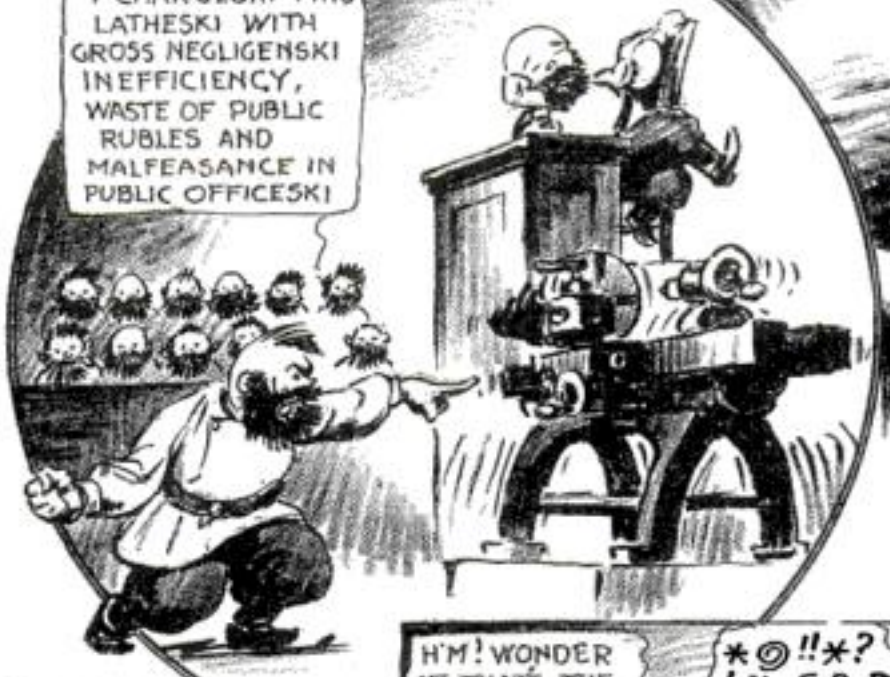
A graduate holder is easily made by bending a piece of wire as demonstrated above, leaving eyes for screws and the jaws open to slip around the neck of the glass graduate

SCIENTIFICKS

...OUR ARTIST VIEWS THE STRANGE AND UNUSUAL FACTS DISCLOSED BY LEADING AUTHORITIES IN THE LAST MONTH

A WATERSPOUT CARRIES A COTTAGE HALF A MILE ACROSS AN OHIO LAKE

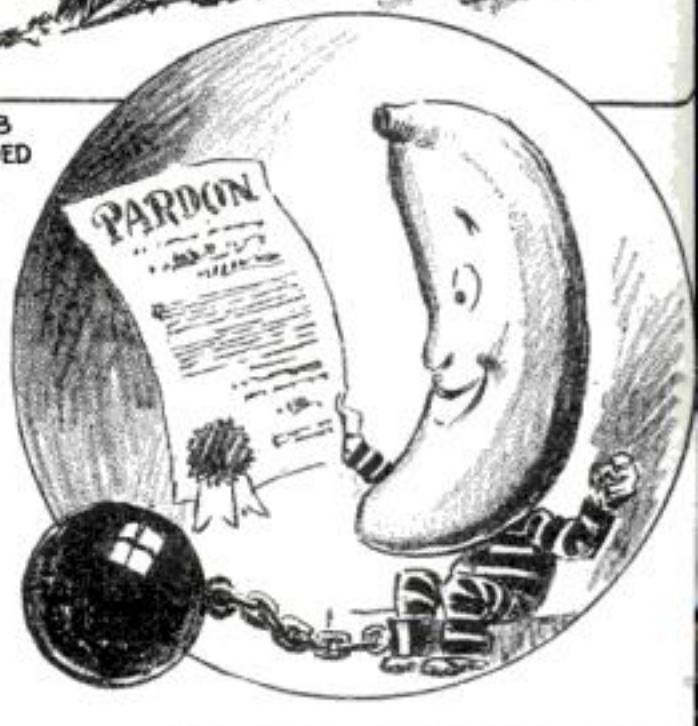
BECAUSE SOME FAMOUS OPERA SINGERS CANNOT ACT, LEOPOLD STOKOWSKI, ORCHESTRA CONDUCTOR, IS DEVELOPING A METHOD OF REPRODUCING THEIR VOICES ELECTRICALLY WHILE ACTORS PLAY THE PARTS



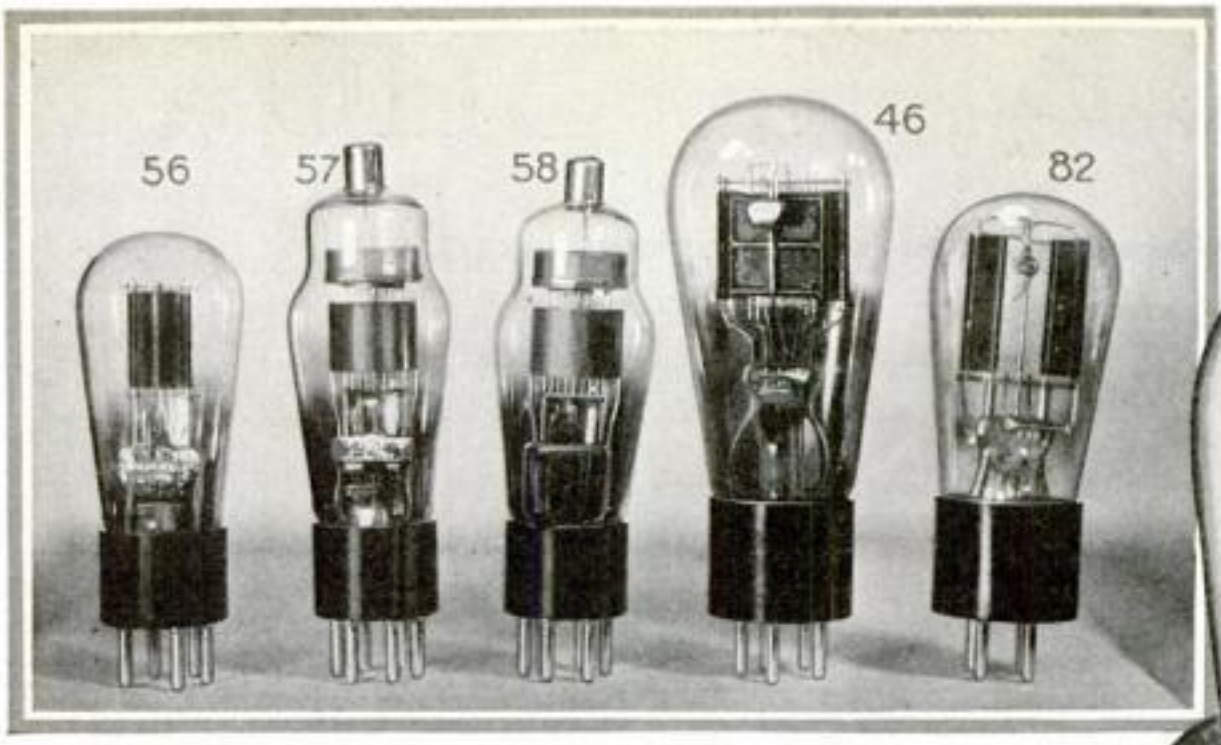
AN ENGINE LATHE HAS BEEN SUBJECTED TO A COURT TRIAL IN MOSCOW, RUSSIA, ON CHARGES OF BEING "TOO EXPENSIVE, TOO COMPLICATED, AND UNNECESSARY"

CAVEMEN DID NOT CLUB THEIR BRIDES BUT WOOED THEM BY SHOOTING HARPOONS INTO THEIR LEGS, ANNOUNCES COUNT RE'NE' DE PERIER, FRENCH ARCHEOLOGIST

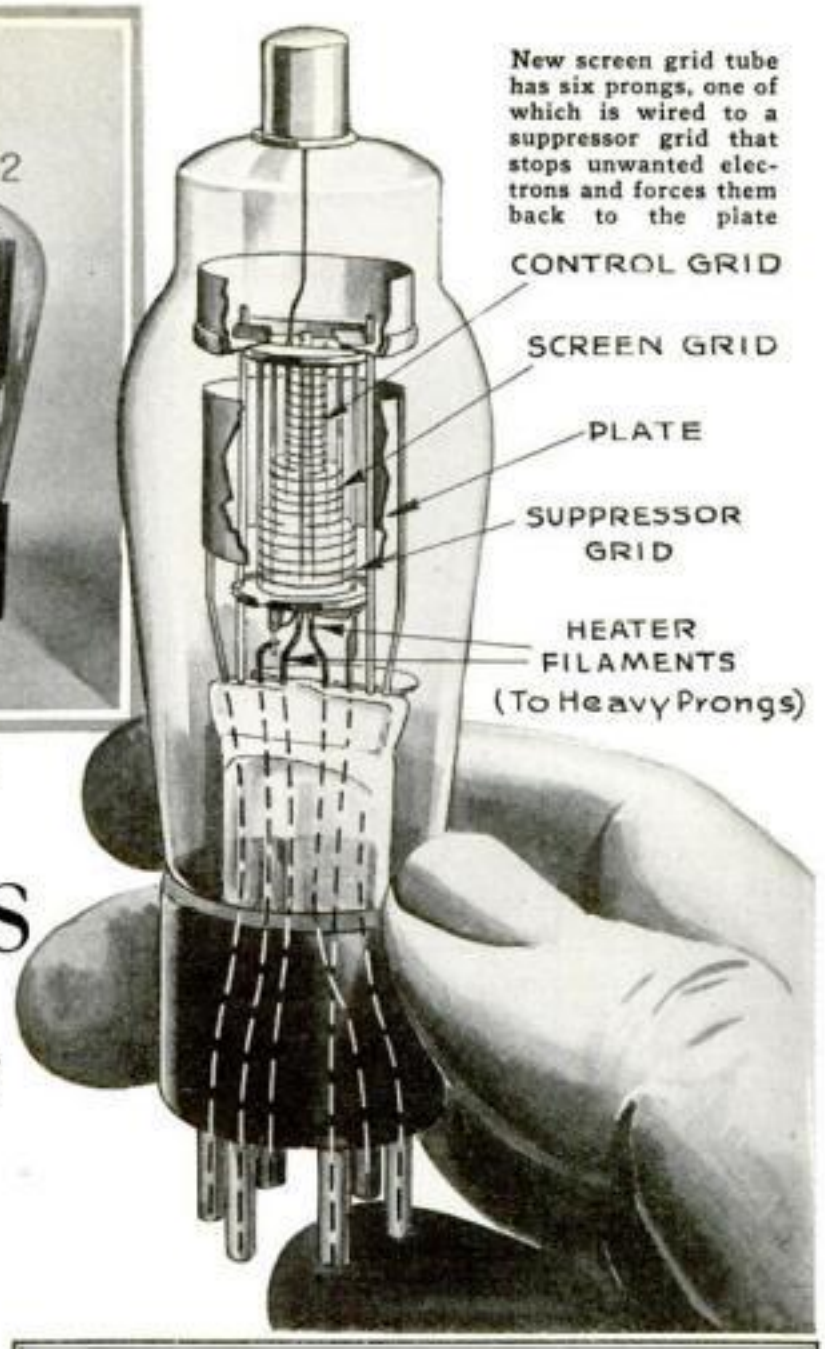
A DIET OF HERBS AND MILK, AND, IN EXTREME CASES, A WEEK'S FAST WILL CURE A BAD-TEMPERED HUSBAND, SAYS DR. JOSIAH OLDFIELD OF LONDON, ENGLAND



BANANAS ARE NOT HARD TO DIGEST, BUT EFFECTIVE IN CURING DIGESTIVE AILMENTS OF CHILDREN, ANNOUNCES DR. SIDNEY V. HAAS, OF NEW YORK



Five new type tubes which will supplant the old ones in receivers out in the fall



New screen grid tube has six prongs, one of which is wired to a suppressor grid that stops unwanted electrons and forces them back to the plate

New Radio Tubes

Show Startling Changes

By ALFRED P. LANE

ENGINEERS and production men in every radio factory are now putting the finishing touches on remarkable new radio receivers. When these advanced models are exhibited at the radio shows this fall, you will get a new idea of price and performance.

You will recognize few old friends in the radio tubes you see lined up in the new sets. The old familiar stand-by, the 227 A. C. heater type general purpose tube, will be gone. No longer will you see the bulging, capped tops of screen grid 224 and 235 variable mu tubes. Even the 245 power tube, the 247 power pentode, and the universally used 280 rectifier will not appear in half of the sets on display.

A whole new line of radio vacuum tubes has emerged from the research laboratories. They present amazing electrical possibilities which call for entirely new forms of receivers. A supply of these tubes for experimental work has been in the hands of each radio manufacturer for some months.

A radio receiver functions because of its vacuum tubes. The electrical characteristics of the set must therefore be such as to work the tubes to best advantage. Learning how the new tubes differ from those now in use will help you understand what may be expected of receivers engineered to fit them.

All the new radio vacuum tubes, representing the latest advances in the art, are shown at the top of this page. Reading from left to right, they are numbered 56, 57, 58, 46, and 82. Note that the new tubes carry only a two-digit number. This is a step in the right direction as the first of the three numbers formerly used was of no significance in determining the physical specification of the tube.

Of all the new tubes, type 56 comes nearest to resembling the old 227. It will be used in the new circuits as an oscillator and second detector and in some sets as an audio amplifier where a stage requiring a tube of this type is employed.

The type 56 is fitted with a five-prong base. It also requires two and one half volts applied to the heater, but the current drawn at this voltage is only one ampere, three quarters of an ampere less than the amount required by the 227. This represents a definite power saving. Its characteristics are such that it will give somewhat better results than could be obtained from the 227 under like conditions.

It is possible to substitute type 56 for 227 in sets now in use, but in some receivers trouble may be experienced with excessive heater voltage. This will occur in sets where the power supply requirements have been engineered to close limits and the reduced current drain results in an increase in heater voltage. It is doubtful if substitution is worthwhile in any case as the increased results would be slight.

The new 57, second in the row, takes the place of the old 224. Electrically it is related to its predecessor only in that it is a screen grid tube. Structurally it is quite different. The heater supply is the same as that for the type 56, which means still another saving in the current required to operate the receiver.

The form of the glass tube is unusual and the belted effect serves a definite purpose. The abbreviated cylinder, crowning the elements in the tube, is all that is left of the outer screen of the old screen grid tube. When fitted with a necked shield, corresponding to the shape of the tube, it actually forms a skirt for the short cylinder inside the glass and results in maximum effective shielding.

Note the new six-prong base. The extra prong is necessary, as the tube is fitted with a suppressor grid in addition to the other elements. This grid performs a function similar to that of the suppressor grid in the old 247 power pentode. It stops electrons, knocked off the plate, from flowing over to the grid and forces them back to the plate.

The six-pin socket makes it impossible to use the new tube in place of the old 224 in sets now in use.

The principal use of type 57 in the new sets will be as a first detector and possibly as a *(Continued on page 110)*

Do You Know What PUSH-PUSH Is?

New receivers are being developed to make the most of novel types of radio vacuum tubes. Be sure to read this article explaining their amazing electrical possibilities. Don't miss the article next month which will show how advanced ideas in radio tubes will improve the receivers soon to be introduced at the radio shows.

•How to Complete Your SHORT

FINAL DIRECTIONS to Get Amateur Radio Transmitting and Receiving Outfit Ready to Go on the Air—Fitting Antenna to Your Location—Connecting the Sending Key into the Circuit—Power Supply

By JOHN CARR

Long glass insulators, like one shown above, are excellent for your transmitting antenna

THE amateur short wave transmitter which I told how to build last month forms part of a complete amateur transmitting station.

In addition to the transmitter, you will need a suitable transmitting antenna, a power supply unit, and a keying system so that you can make the transmitter send out the dots and dashes of the radio code.

The ideal transmitting antenna should be free of all support and clear of buildings, trees, or any form of steelwork. However, these ideal conditions are rarely encountered. The amateur always has to take conditions as they are and make the best of them, for elaborate antenna masts and other special equipment are expensive.

Your first job is to study your location to see which type of antenna will prove most suitable, everything considered.

The simplest form consists of an installation much like the usual broadcast receiving antenna. One end of the antenna coil of the transmitter is grounded, and the ground must be good. The other end is connected by way of a radiation meter (thermo-milliammeter) and any spare variable condenser you have handy. If no meter is available, a flashlight bulb often will serve on a low-powered set.

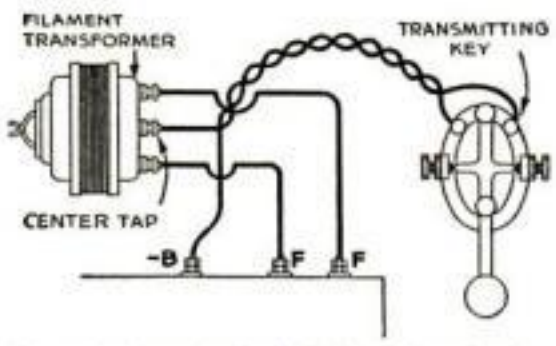
An installation of this type will prove satisfactory if the outfit is located where you can get a short connection to moist earth for the ground and the house itself is of frame construction with few surrounding buildings. In most cases the antenna circuit will show broad tuning qualities and will work at different wave lengths.

Assuming that the ground lead is very short, the best length of antenna, measured from the antenna binding post on the set to the far end, should be seventeen feet for work on the twenty-meter band, thirty-two feet for the forty-meter band, and sixty-four feet for the eighty-meter band.

In many locations the antenna ground system is not practical because of dry, sandy soil or the difficulty of getting a short ground lead. The antenna-counterpoise system gives excellent results in such cases and eliminates the need for a ground connection.

Instead of a ground, use a counterpoise, which is a wire of the same length as the antenna, equally well insulated and stretched over the ground beneath the antenna. The counterpoise can be hung six feet above the ground when head clearance is necessary, but the distance between the antenna and counterpoise should be not less than ten feet.

The amateur who lives in an apartment, where the steel framed building towers above his windows, faces special problems. Even if he strings his antenna straight up the side of the building, the allowable length for the wave he wishes to use will result in an antenna badly shielded by the steel in the building.



How the key is hooked into the circuit

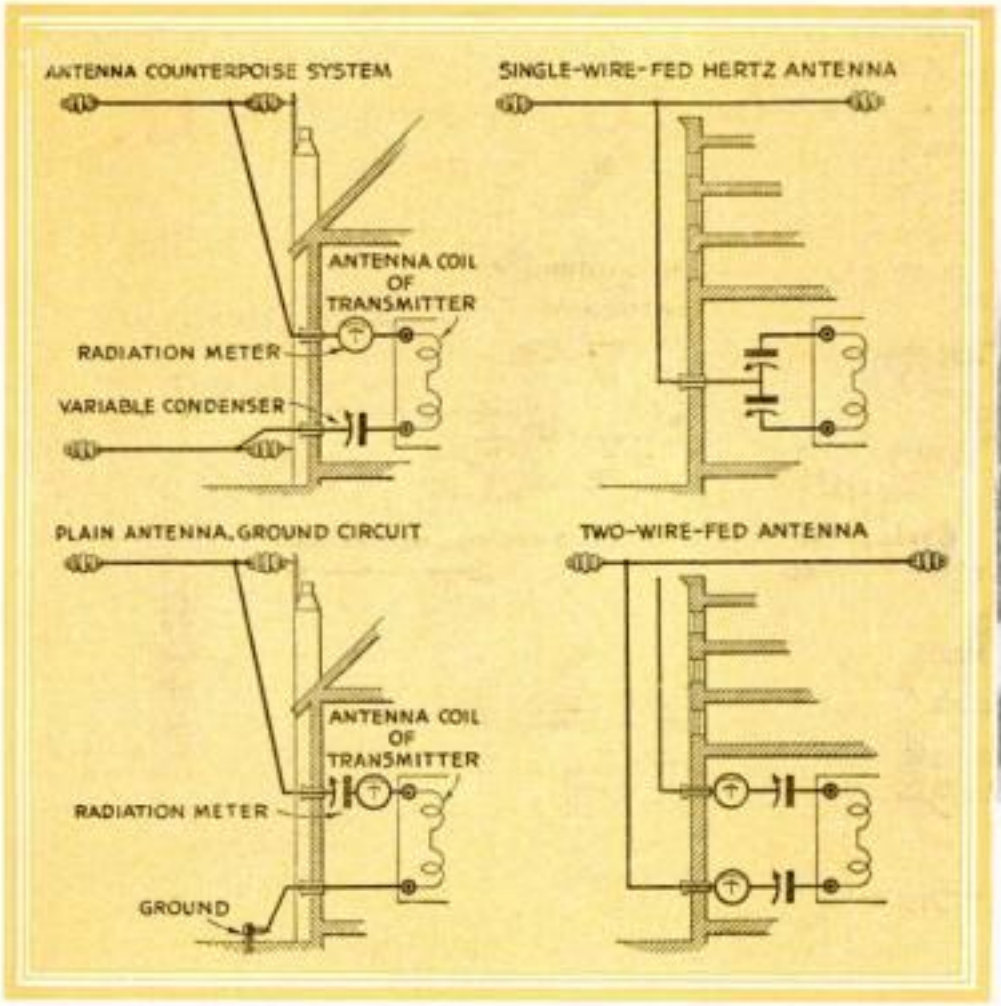
The solution is to use such an antenna system that the lead-in wire can be made as long as desired without affecting the natural wave length of the antenna. The diagram at top of page 65 shows antenna arrangements that meet these requirements. One, the single-wire-fed Hertz antenna, consists of a single wire strung horizontally as high above the level of the roof as is convenient, with a feeder wire running down the side of the building to reach the antenna binding post.

Both the length of the antenna and the location of the point of connection to the feeder wire are vitally important. For the twenty-meter band, the antenna should be exactly thirty-three feet eleven inches long and the feeder wire should be connected at a point exactly four feet nine inches from one end—it makes no difference which end. For work on the forty-meter band, the antenna should be sixty-seven feet ten inches and feeder nine feet six inches from one end; for eighty-meter work, length one hundred thirty-five feet and feeder eighteen feet eleven inches from one end.

An antenna of this type tunes sharply. It will work only on the wave for which it is designed, or on a harmonic of that wave. An eighty-meter band Hertz an-

This picture shows how the frame and lever connection to the key goes to minus B with the insulated contact under the key wired to center tap of the filament transformer

WAVE Station



Above, checking the frequency setting of the transmitter at Popular Science laboratory. At left are the recommended antenna circuits, two of which are for small houses while the others are suitable for those who live in apartment houses

tenna can therefore be operated on the frequency for which it is designed, or on the harmonics of this frequency in either the forty- or twenty-meter bands.

The so-called two-wire feed system is a more elaborate Hertz antenna. Two feed wires are used, but only one is connected to the antenna. The unconnected wire must be of exactly the same length as the connected feed wire and must be strung up parallel to it a few inches away in a symmetrical arrangement. Both feed wires must be equally well insulated.

For transmission on the eighty-, forty-, and twenty-meter bands, the antenna should be exactly 131.2 feet long. The connected feed wire is attached at one end of the antenna. The pair of feed wires may be of any length necessary provided they are alike.

No matter what type of antenna you put up, adequate insulation is extremely important—far more so than in any radio receiving antenna. Do not use cheap "molded mud" insulators. Pyrex glass insulators are excellent. Remember that the insulation should be equally good at every point of support for the antenna or leads to it. One poor insulator may spoil your chances of getting good distance.

Remember, also, that the Underwriters' regulations require that a grounding switch be used on all transmitting antennas. Suitable radio type antenna grounding switches can be obtained from a dealer. The switch arm of the single-pole double-throw switch should be connected to the antenna lead wire. One jaw of the switch should be wired to the antenna binding post of the set and the other should be grounded outside the house by way of a heavy wire. When the set is not in use, the switch must be closed on the grounded side.

The power required to operate the transmitter will depend on the tubes you use in it. If no electric light current is available, you can use a six-volt battery with a rheostat in the circuit to heat the filaments of two type 171A tubes. The plate voltage can be obtained from four heavy duty forty-five-volt B batteries.

If 110-volt alternating current is available, the same tubes can be operated with a five-volt filament heating transformer to heat the tubes and either a home built or factory made B eliminator to supply the needed plate voltage.

If you wish to build your own B supply unit, it should follow conventional lines for B eliminators.

So many different types of power transformers and other B circuit parts are now for sale at low prices that you will have no difficulty in buying just what you want. When you see your dealer, take along your copy of POPULAR SCIENCE MONTHLY if you are a bit hazy as to the exact requirements for each part. He will tell you at once just what is required and help you pick out the right parts.

BLUEPRINTS WILL HELP

More complete details of antenna construction and power supply circuits are given in Blueprints Nos. 183 and 184, as well as full information on the building of the amateur continuous wave transmitter unit. See page 96 for blueprint order blank.

For maximum power with the transmitter described last month, use type 210 tubes. These tubes require a seven-and-one-half-volt filament heating transformer and a B supply circuit that will supply 100 milliamperes or more of current at from 450 to 500 volts.

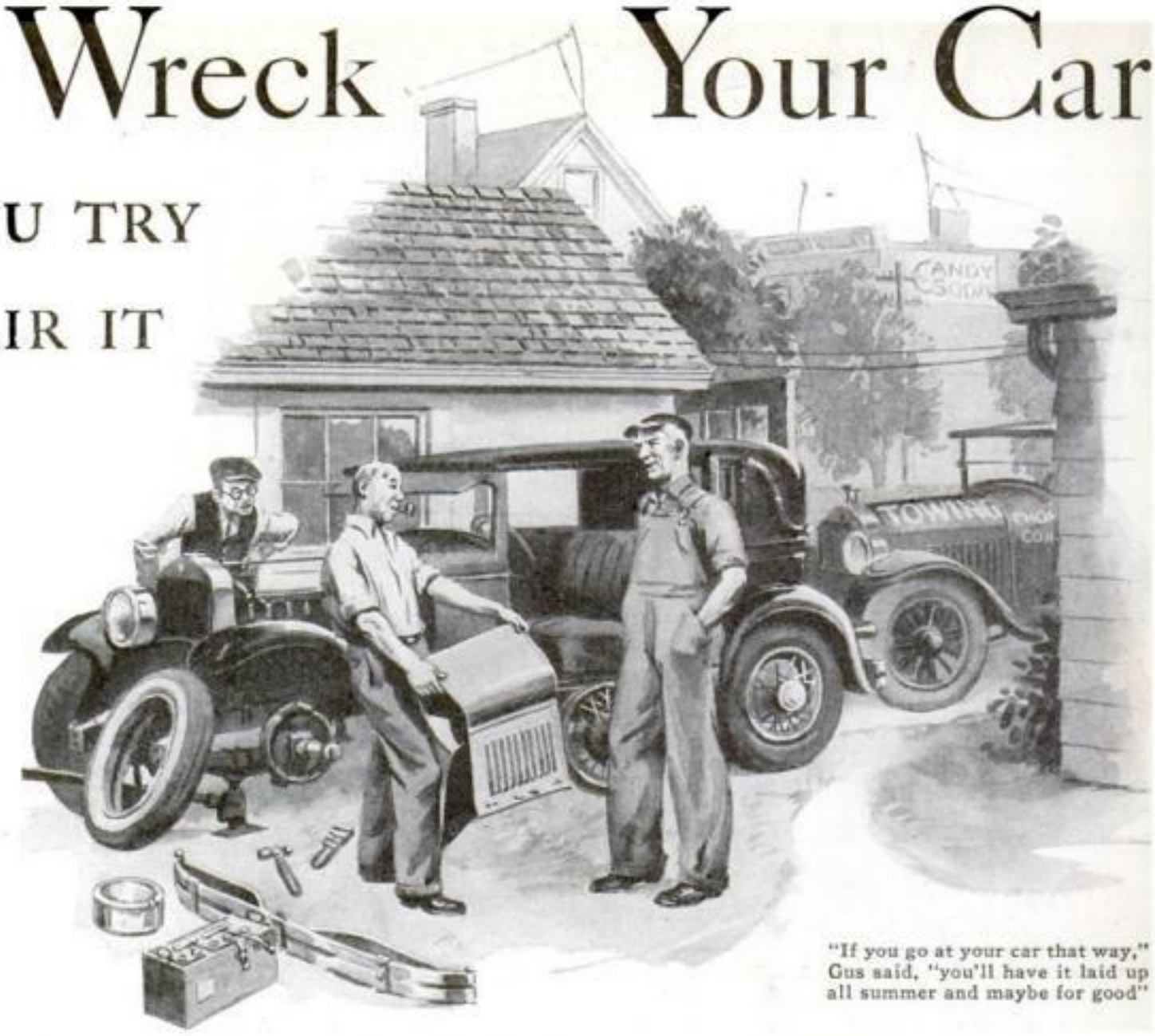
There are a number of ways to connect the operating key to the transmitter. A common and quite satisfactory method is shown on the opposite page. It shows how to wire the key so that it interrupts the connection between minus B and the center tap of the filament heating transformer. When the key is up, the circuit is open and the tubes remain lighted but do not oscillate. When the key is depressed, the tubes oscillate and send out a dot or a dash depending on the length of time the key is held down.

In this circuit, minus B is grounded, so be sure that the moving arm of the key is connected to minus B with the small insulated contact underneath it, connected to the center tap of the filament heating circuit.

The unforgivable sin in amateur transmission is to operate your set outside the wave bands or frequencies specified by the Government. The picture above shows the short wave transmitter being calibrated with a wave meter in the Popular Science Institute laboratory. One of these instruments should be part of your equipment. They can be purchased complete with the necessary calibration charts or you can build one yourself. Next month I will show you how to do this. In the meantime, if you get your transmitter ready for use and get your Government Amateur Station License, don't go on the air unless you can find some amateur with the necessary equipment who is willing to help you calibrate your set.

Don't Wreck Your Car

WHEN YOU TRY TO REPAIR IT



"If you go at your car that way," Gus said, "you'll have it laid up all summer and maybe for good"

By MARTIN BUNN

"ON THE phone, Gus!" Joe Clark bellowed, and in a moment or two Gus Wilson, his partner, stepped into the tiny office of the Model Garage. He wrapped a huge and grimy paw about the receiver.

"Sure, Jim," he said after a pause, "I'll stop in on my way home tonight."

Gus dropped the receiver into the hook. "That was Jim Farrel, sort of a cousin of mine," he explained. "His car needs a lot of work done on it, and he figures, with a couple of hints, he'll be able to fix it himself. Wants me to tell him what to do."

"I know Jim," Joe answered, "and he'll take a powerful lot of telling. I'll go along. Maybe I'll learn something, too!"

At closing time they headed for Farrel's house.

"Jumping catfish!" Gus growled as they pulled into the driveway. "Take a look at what he's done! It's a good thing we got here quick. Going into the auto-wrecking business, Jim?" he asked.

"Not if I can help it," Jim said with a grin, trailing a black streak across his face as he wiped away the perspiration. "I was just starting to take it apart so I could get to work on the overhauling."

The veteran auto mechanic gazed at the miscellaneous array of parts that had been removed. One wheel was off, a headlight rested on the ground, the bumper was off, the battery out, and bolts and nuts were scattered all over the place.

"If you go at it that way," Gus told him, "you'll have the car laid up all summer and maybe for good. You remind me of the sap who ordered a carload of lumber before he decided what kind of a house he was going to build.

"Before you opened the tool kit," he continued, "you should have made out a list of what needed to be done. Then you should have tackled one job at a time, starting with the one that was most necessary. That way you get the work done little by little and your car'll only be laid up a few days at a time."

"Oh, is that the way you do it?" asked Jim somewhat sheepishly. "Well, you know what a car needs a lot better than I do."

"Humph!" Gus grunted as Farrel wiped his hands and fished out a notebook and a stub of a pencil. "If I were to tell you all the things this car needs done to it, we'd be here the rest of the night. That's one of the funny things about overhauling an old car, you never know where to stop.

"The simplest way is to consider the car as just so much transportation. In that case you do whatever work you can justify on a cost per mile basis and let all the rest go. Your wife, of course, wouldn't be satisfied, for most women would rather have the dents taken out of the fenders and a new coat of paint put on than have you spend money and time fixing the motor so it runs better and uses less gas and oil. Some men think that way, too.

"Anyhow," he went on, "no matter how you figure, the first item on your list ought to be the brakes, and the second should be the steering mechanism and the rest of the running gear. Dents in the fenders and a shabby appearance may hurt your pride and a motor breakdown will be mighty inconvenient, but brake or steering gear failure is likely to put you where you won't have any more use for a car!"

"Reline brakes," muttered Farrel as he started writing. "They're punk, I know. I'll put the rest of the stuff back and spend Sunday on the brakes."

"As for the steering mechanism," said Gus, "you may not have to do a thing to it, but while you have the wheels off for the work on the brakes, it's easy to look it all over and see if the king-pins have too much play—a little won't do any harm—and also check the linkage to see nothing is coming loose; no cotter pins missing and so on.

"Look over the front wheel bearings to make sure there are no cracked rollers or balls and if you want to be really fussy, clean 'em out and put in new grease. See that the rear hubs are tight on the axles, too."

"Should I pull the rear axle apart to see if that's all right?" Farrel interrupted.

"Why?" Gus demanded. "Unless your rear axle hums or there's too much play when you jack up one of the wheels and rock it back and forth, you'd better let well enough alone. Of course, it's a good idea to flush it out and put in new lubricant, but that has nothing to do with overhauling. It's one of those jobs that ought to be done regularly at the times specified on your oiling chart.

"If you've got a bad hum or a grind in the rear end, that's something else again. In that case you ought, at least, to open up the rear cover and see if the gears are chewed up or the ring gear is working loose on the differential housing. A noise that sounds *(Continued on page 107)*

GUS says:

The day has long since passed when every motorist had to carry along a regular machine shop or take a chance on spending the night in somebody's barn. But just because service stations are so handy is no reason you shouldn't carry along a jack, a tire pump, and a few good tools for emergencies.

$200 in Cash Awards

to encourage you to build yourself a

GEORGE WASHINGTON

COACH MODEL

George Washington's inaugural coach as it appeared recently in a New York parade

FOR its many model making readers, POPULAR SCIENCE MONTHLY offers a new and timely competition based on the great bicentennial celebration of George Washington's birth which is now in full swing throughout the country. The project is to build a small scale model of any coach in which Washington rode, and the following cash awards will be made:

First prize	$100
Second prize	75
Third prize	15
Fourth prize	10
Total	$200

As you will see from the rules on the following page, all you have to do is to send in photographs and working drawings of your model. You keep the model itself. The contest is merely to encourage a little friendly rivalry.

All the Washington coaches are of more or less the same general design, and their fine proportions and slender undercarriages make them extremely decorative.

One authentic Washington coach, still sturdy and intact after 143 years, was recently lent to the City of New York by its owners, the Historical Society of Frankford, Pa., for use in a historical pageant reënacting Washington's inauguration. It is in this coach, it is believed, that our first president rode in the original inaugural parade on April 30, 1789.

Although only a dim vestige of its original color remains, the coach is otherwise in excellent condition. The graceful undercarriage, made mostly of hand-wrought iron, is a revelation in expert craftsmanship.

To assist readers who desire to build an authentic Washington coach, careful measurements and sketches were made, and these, together with several special photographs, appear on this and the following pages. All the illustrations, in fact, are of this coach except the last photograph on page 69, which shows another Washington coach on exhibition at Mt. Vernon.

As in all model making projects, readers will find that the construction of the coach, especially the undercarriage, can be simplified without any great loss of realism. Many parts can doubtless be entire-

A side view of the coach and, above, a drawing of the crest on the doors

HOW TO ENTER
The George Washington Coach Contest

ALL you have to do to enter this contest is build a scale model of any authentic George Washington coach and send at least two clear photographs of it, together with your original working drawings, to the Washington Coach Contest Editor, POPULAR SCIENCE MONTHLY, 381 Fourth Avenue, New York, N. Y., on or before November 1, 1932. The model may be constructed to any scale not larger than ⅛ in. equals 1 in., but indicate clearly what scale you have used. Describe the coloring of the model. If you do not build the inaugural coach, tell what particular George Washington coach formed the basis for the model and where it is at the present time. If you obtain your information from books, give a complete list of them together with the authors' and publishers' names. The drawings submitted with your entry need not be inked in since they will not be judged for draftsmanship, but they should show the construction accurately.

Each model will be rated on (1) its general appearance, (2) craftsmanship, and (3) authenticity. In case of ties, each tying contestant will be awarded the prize tied for.

This contest is open to all except employees of POPULAR SCIENCE MONTHLY and their families. Only one model may be entered by each contestant. The judges of the contest will be the technical and home workshop editors of POPULAR SCIENCE MONTHLY, and their decisions will be final. They will have the right to ask any contestant to send his actual model to New York for their inspection, with the understanding that the model will remain his and will be returned.

If you desire your photographs and drawings returned after the contest is over, inclose a self-addressed and stamped envelope or label with your entry. The four winning entries (photographs and drawings) will not, however, be returned.

ly eliminated by the ingenious worker. Those building their first original coach model without scaled plans will find many useful hints in previous coach model making articles (P. S. M., Feb. '30, p. 77; June '30, p. 75; Apr. '31, p. 97; and Jan. '32, p. 73).

Before beginning the actual construction of the model, a convenient scale (not larger than ⅛ in. equals 1 in.) should be decided upon, and careful full size pencil sketches made of the various parts of the undercarriage and body. These sketches will prove a great assistance in the actual construction of your model.

Over-all the inaugural coach is 12 ft. long and 8 ft. 4 in. high. The body, shaped like a double wedge, is 10 ft. long at the top and approximately 6 ft. long at the bottom. The width varies from 4 ft. at the top to 3 ft. 4 in. at the bottom. The body is 5 ft. high and is supported on thoroughbraces so that the bottom is 3 ft. 4 in. above the ground. Although missing on the original coach, steps such as used on the coach on display at Mt. Vernon, Va., and illustrated on page 69, were no doubt used. These fold up inside the coach when not in use. The height of the bottom of the body of these coaches made steps a necessity. In the photo at the top of page 67, which shows the coach during the New York bicentennial celebration, a small ladder is being used as a substitute for the steps.

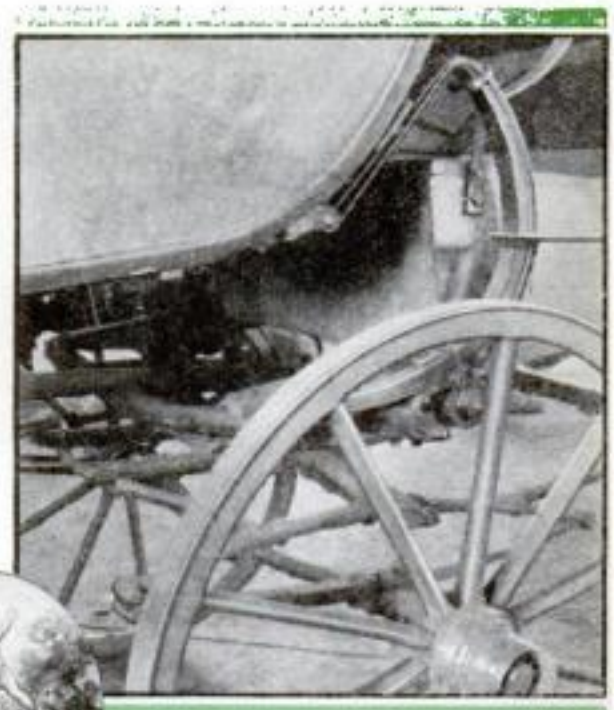
The wheel base of the coach is 6 ft. 3 in. and the tread 4 ft. 5 in. Although the tread of the front and rear wheels is the same, the rear wheels have a camber (slant) that brings their top edge 5 in. farther out than their lower edge. The front wheels, 3 ft. 4 in. in diameter including the metal rim, have ten spokes while the rear wheels, 4 ft. 7 in. in diameter, have twelve. The felloes are made in halves (semicircles) and are 1½ in. wide and just as thick. The welded iron rims are ⅜ in. thick and 1¾ in. wide.

The thoroughbrace springs, made up of five leaves each, support the body through thoroughbraces. The top ends of the front thoroughbrace springs are 4 ft. 6 in. above the ground while the ends of the rear ones are 2 in. higher. The leather thoroughbraces are connected to metal clips fastened under the bottom curve of the body as shown in the detail photograph below. The slack in the thoroughbraces can be taken up by small reel-like drums at the base of each thoroughbrace spring.

Both axles on the original are metal. The front and rear bolsters are supported above the axles on 2 ft. 11 in. long springs having a maximum bow of 4½ in. The reach, curved down in the middle to allow 9 in. additional room for the body, is also metal. It is 8 ft. 7 in. long and has a section 2 in. square. The details of the undercarriage are clearly shown in the perspective drawing on page 69.

Two wooden beams, fastened with bolts to the front bolster and to the crosspiece in back of the bolster, support the 3 ft. 4 in. long and 16 in. wide driver's seat. The iron seat supports are fastened to a box-like platform built up on the forward ends of the two wooden beams. The footboard, bolted to iron braces which form a part of the seat support, is 3 ft. long and 14 in. wide. The cushion on the driver's seat is leather covered (see photograph on page 69 for details).

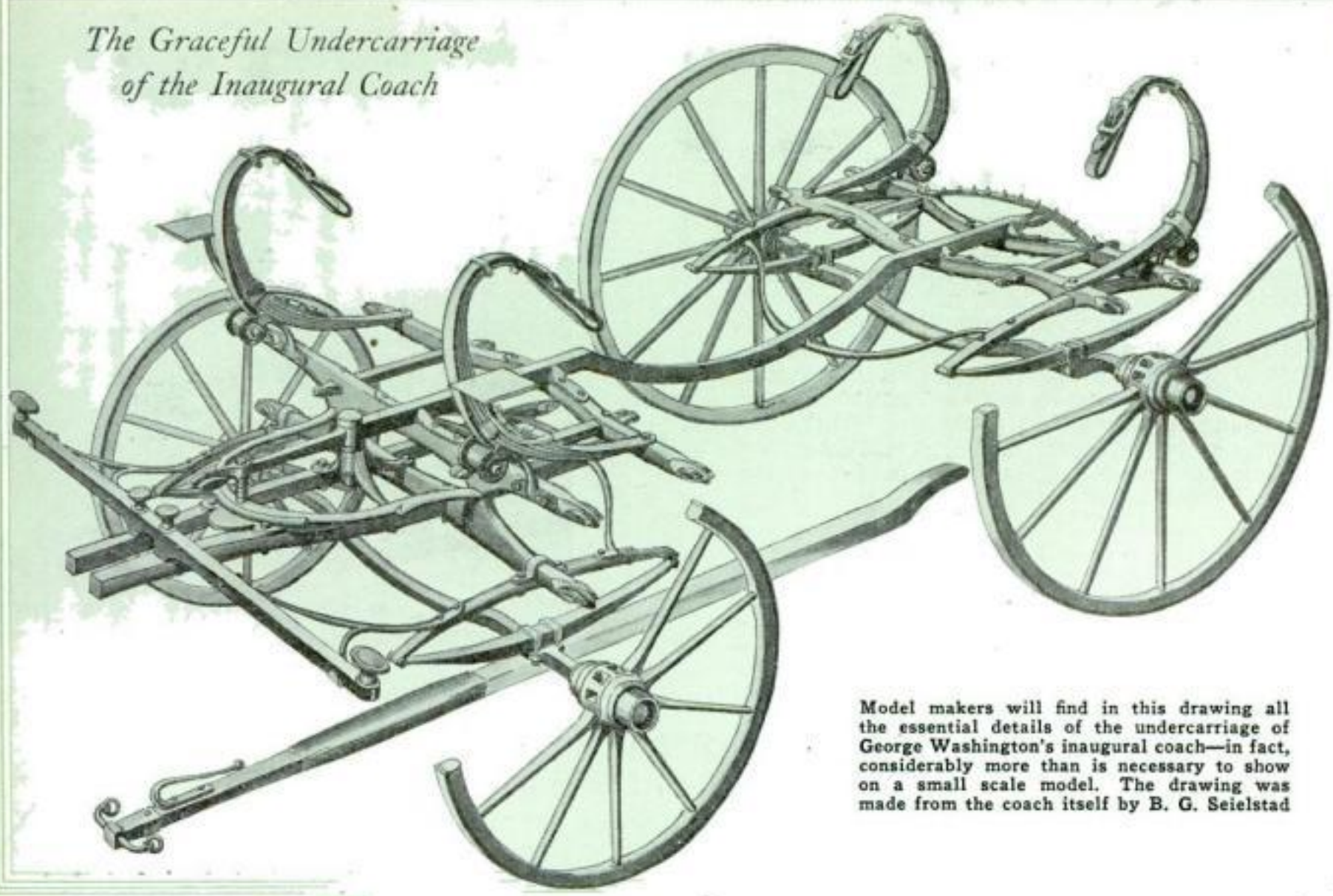
The coach body is finished in two colors—dark olive green on



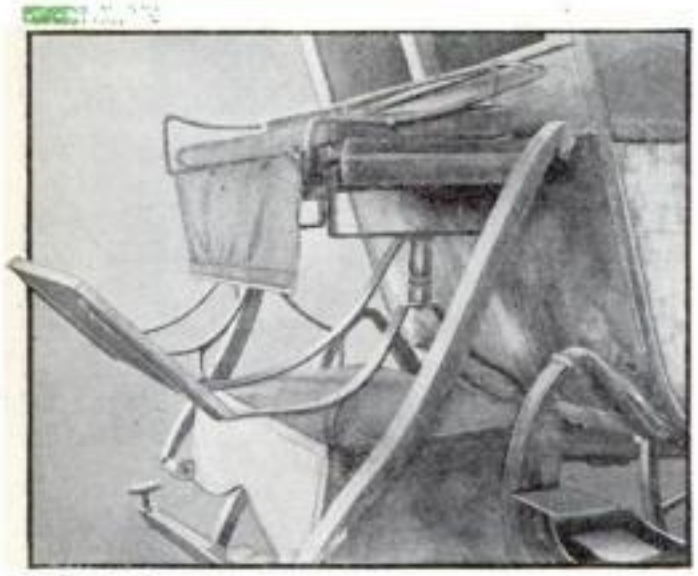
A close-up photo showing how the body is suspended by means of thoroughbrace springs and straps

The coach with a temporary platform added for the footmen and, above, the decorations on the side panels

The Graceful Undercarriage of the Inaugural Coach



Model makers will find in this drawing all the essential details of the undercarriage of George Washington's inaugural coach—in fact, considerably more than is necessary to show on a small scale model. The drawing was made from the coach itself by B. G. Seielstad



The grace of the ironwork again appears in this photograph of the coachman's seat

the upper half and cream on the lower half. A trim of light mahogany color forms the paneling around the door and an edging around the body. On each door is a colored reproduction of George Washington's crest with the words, EXITUS ACTA PROBAT—"the outcome justifies the deeds." A sketch of this crest is given on page 67. The heraldic bird at the top is silver and rests in a crown of gold. The helmet is silver and the background of the shield is gold. As shown in the drawing, the two bars, three stars, scroll containing the motto, and the lambrequin or ornamental streamers coming from the crown of the helmet under the gold crown are red. The lambrequin is edged in silver. The motto is lettered in gold.

The panels at each side of each door are embellished with the colored decorations shown on page 68. These are shown in the following order: left rear, left front, right front, and right rear. The figures are flesh color with gold hair, the ground is brown, and the foliage in the background is dark green. These decorations and the crest measure approximately 14 in. high and 11 in. wide. The placing of the decorations is shown in the photograph at the bottom of page 67.

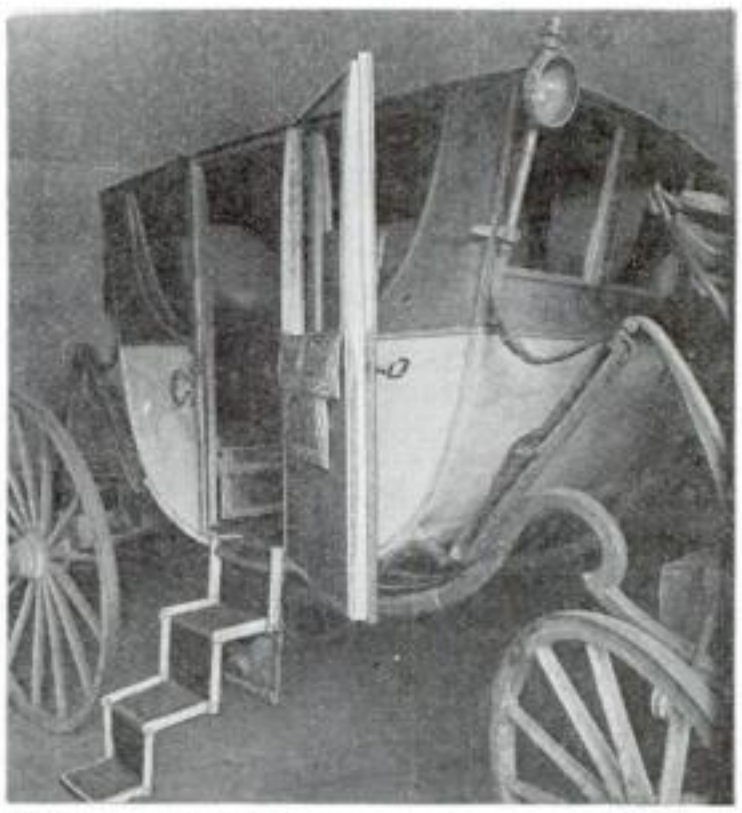
The windows on each side of the coach are quadrant shaped, their sides measuring approximately 27 in. The two rectangular windows in the front of the body are 23 in. high and 19 in. wide. These are placed about 4 in. down from the top. In the rear of the coach, 9 in. down from the top, there is a circular window measuring 13 in. in diameter. No glass was used in the windows of this type of coach, slatted shutters being used to keep out the rain and wind. (The photograph at the bottom of this page—the coach at Mt. Vernon—shows more clearly the construction of this type of coach window.)

The pole, made of wood and having iron fittings, is 10 ft. long. A sketch of the pole is given in the drawing of the undercarriage. At about 2 ft. back from the front end it is protected with leather padded with felt and horsehair. This padding extends back for about 2 ft. A bolt passing through the socket in the undercarriage serves to hold the pole in place. The pole is painted black.

When this original Washington coach was used in the recent New York pageant as pictured on pages 67 and 68, a platform was constructed on the rear of the undercarriage to accommodate two coachmen. No indication of such a structure, however, was found on the original undercarriage of this coach.

The upholstery of the body is entirely plain, a rough woven material covering the seats and interior walls. On the other hand, however, the upholstery in the Mt. Vernon coach is of fine quality.

One peculiarity the reader will note on studying the various photographs is the absence of brakes of any sort on both the inaugural and Mt. Vernon coaches.



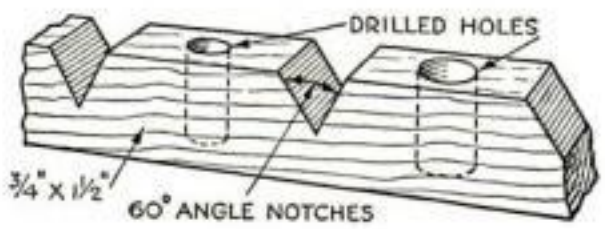
This is another Washington coach—one on exhibition in the coach house at Mt. Vernon. Note the folding steps, the hardware, and the richly finished interior

UNIVERSAL BENCH TOOL RACK

A RACK that will hold almost any tool of small or moderate size consists of two or more parallel wood strips having notches and holes spaced alternately along their top edges as shown in the accompanying illustration. The holes make convenient receptacles for punches, nail sets, pencils, and the like, while the notches are occupied by screw drivers, files, and other tools too long or too wide to be set in the holes.

To make such a rack, obtain several pieces about ¾ in. thick, 1½ or 2 in. wide, and of whatever length you desire. At intervals of from 2 to 3 in. cut notches of about 60 deg. extending halfway through the width of the pieces as indicated in the drawing below. At points along the edge of each strip and midway between these notches, drill holes to a depth that will leave about ¼ in. of wood at the bottoms. These holes can be of various sizes according to the tools which are to be set into them.

Prepare two or three strips of equal length, and mount them so that they are parallel and about 3 in. apart. The notches should line up so that tools can be laid across in the manner shown in the photograph. Such a rack is most convenient when mounted at the back of a workbench. With a little practice it is possible to train oneself to restore each tool to its proper place instead of laying it on the bench. This is a great advantage since the top of the bench is thus kept clear for the work at hand.—VERNON CASE.



The larger tools are laid in the notches of this tool rack, while the smaller and shorter ones are set upright in holes

An amateur photographer can quickly learn the uses of a tripod by making one like this

ERASERS PROVIDE FEET FOR SMALL TRIPODS

SLIP-OVER pencil erasers, which can be purchased for a cent each, make excellent tips for the legs of music stands or photographers' lamp stands. They can be used also on camera tripods if the ends are of small diameter. Stands thus equipped will not slip on smooth floors and are less likely to mar furniture with which they may come in contact.—L.T.E.

LIGHT CAMERA TRIPOD MADE FROM DOWELS

NINE wooden dowel pins, a few strips of hard wood, and some screws will make a lightweight rigid tripod for a box or hand camera. The drawing shows the construction of each of the three legs, which are made of standard ½-in. dowels, 3 ft. long. The piece *A* is attached to the head of the tripod. The legs *B* and *D* are fastened to *A* with long wood screws. The pieces *E* and *F* are the same except that piece *E* has a clamp for holding the sliding leg *C*, and *F* is slightly shorter than *E*. Both are glued and bradded to the legs *B* and *D*.

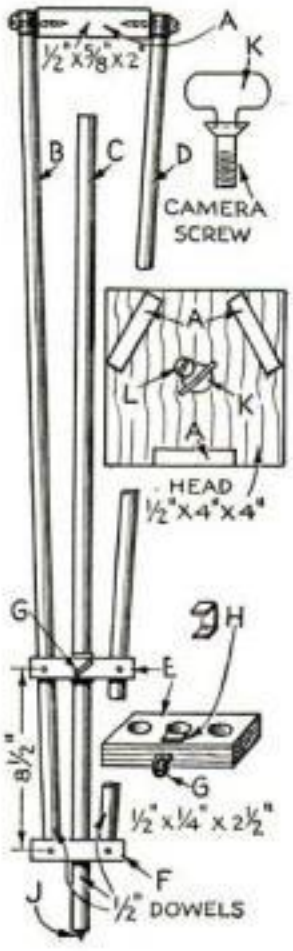
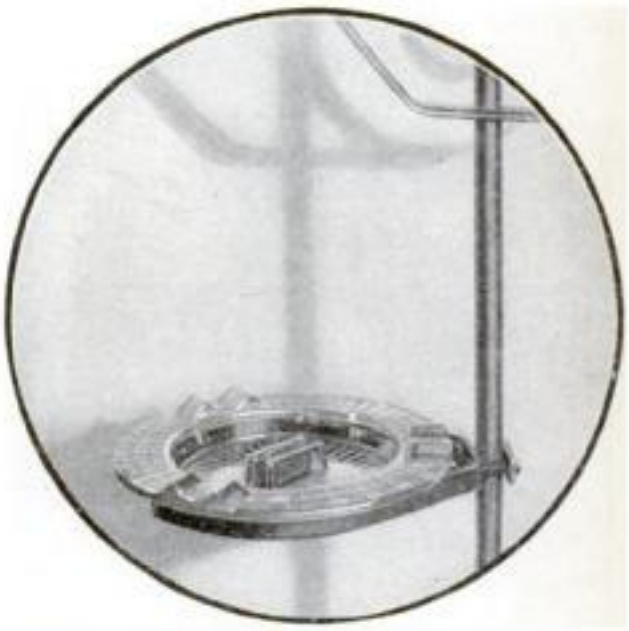


Diagram showing how tripod is constructed

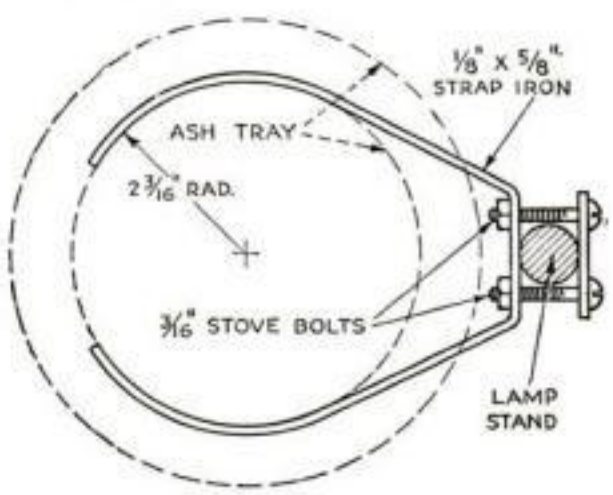
The sliding leg *C* is held by tightening the screw eye *G*. The point of the screw is filed off, and the metal strip *H* prevents the end from scarring the sliding leg. A small screw *J* with a pointed head is screwed into the end of each of the sliding legs. An improvement is to place brass ferrules over the upper ends of pieces *B* and *D* where the screws pass through them.

The head of the tripod is simply a ½-in. piece, 4 in. square. The camera holding screw *K* is made by soldering a key head in the slot of a No. 16/20 flat-headed machine screw. This screw is prevented from dropping out of place by the screw *L*.—DANA S. GREENLAW.

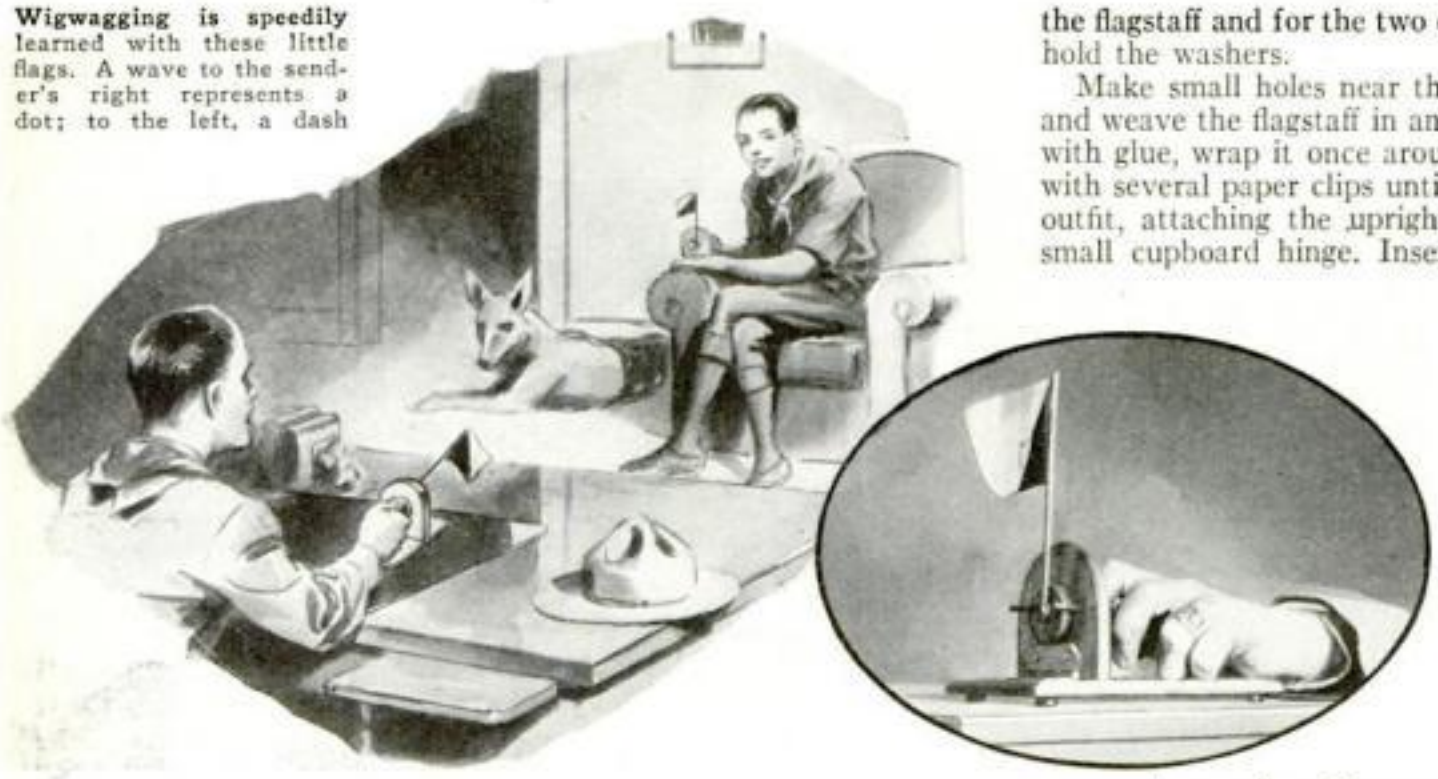


ASH TRAY ATTACHMENTS FOR A FLOOR LAMP

FLOOR lamps, bridge lamps, or reading lamps, especially those with plain metal uprights, will often provide a convenient place for attaching ash trays. The trays may be of any standard design; the type illustrated, which is of glass and can be obtained in practically any five-and-ten-cent store, is well suited for this purpose. The bracket is made of soft steel or strap iron as shown in the diagram below. The clamping device will hold securely whether the lamp stand is round or square. Two trays can be attached if a balanced effect is desired.—A. H. HONEST.

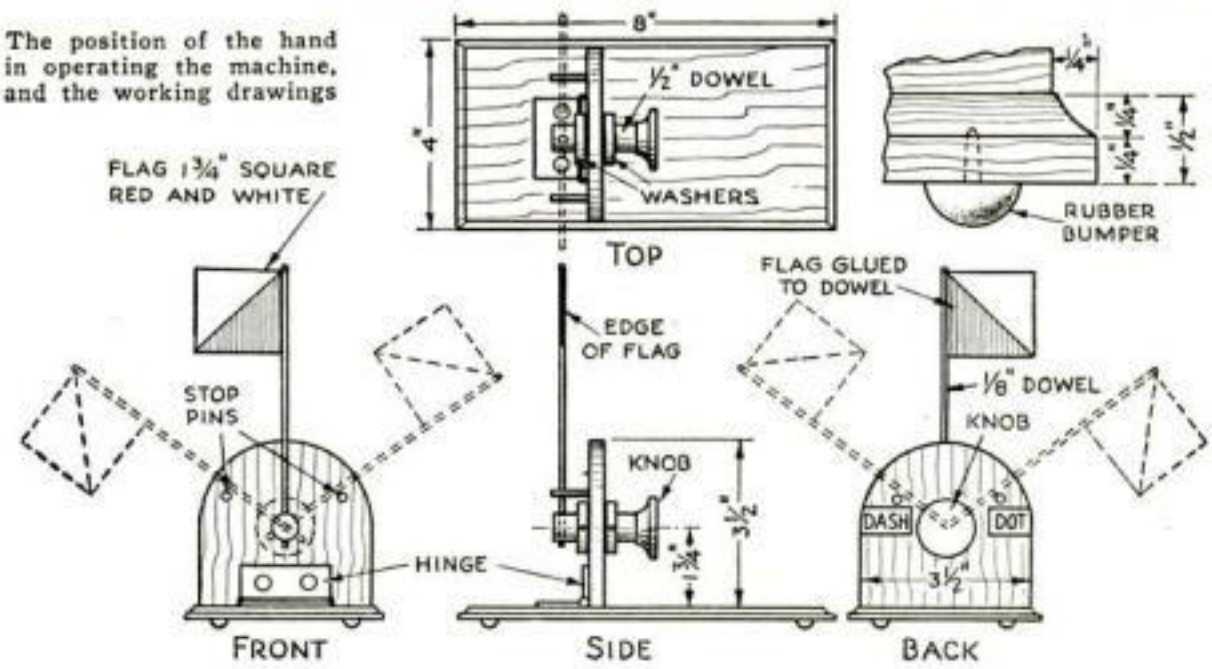


Tiny Wigwag Machine Teaches Signaling with Flag



Wigwagging is speedily learned with these little flags. A wave to the sender's right represents a dot; to the left, a dash

The position of the hand in operating the machine, and the working drawings



Boy Scouts and others interested in visual signaling can practice indoors with this miniature wigwag sender. Considerable speed can be gained with practice.

First cut out and square a baseboard ½ by 4 by 8 in. and plane a ¼-in. chamfer all around. Then make the upright member ⅜ or ½ by 3½ by 3½ in., using 1¾ in. for the radius of the top. In this piece bore two holes where indicated for ⅛-in. birch dowels such as are used in model construction, and a ½-in. hole in the center for the dowel in which the flag is to be set. A suitable ½-in. dowel can perhaps be found on a discarded wooden toy, or one can be obtained at a cabinet shop or hardware store. Find a knob with a screw so that it can be fastened to the end of the ½-in. dowel. Bore a hole for this screw or the dowel may split, and also bore holes for the flagstaff and for the two dowel pins (or cotter pins) which hold the washers.

Make small holes near the edge of the 1¾-in. square flag and weave the flagstaff in and out. Coat the edge of the cloth with glue, wrap it once around the staff, and hold it in place with several paper clips until dry. You can now assemble the outfit, attaching the upright member to the base with any small cupboard hinge. Insert the ½-in. dowel through the upright with the washers in place, drive in the two dowels or pins, and insert the flagstaff.

The hinge makes it possible to give the interval signal, the end of a word being indicated by one dip to the front, the end of a sentence by two dips, and the end of a message by three dips. The dot and dash code (International Morse Code) used in telegraphy and wigwagging can be found in dictionaries, encyclopedias, and handbooks.—Hubert E. Mishler.

AMUSING CUT-OUT NAPKIN RINGS FOR CHILDREN

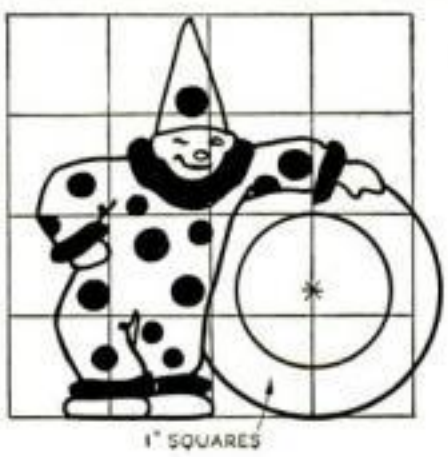
Children will enjoy folding their napkins neatly if they have these amusing little wooden rings in which to put them.

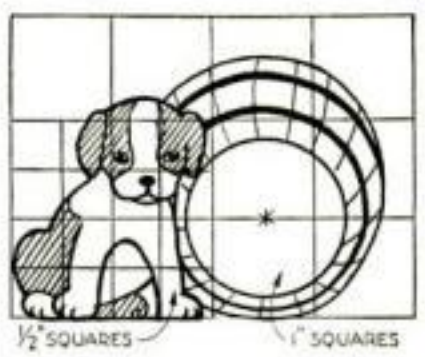
The patterns will not be difficult to prepare if you mark your diagrams into squares as indicated in the drawings. To make the pattern for the pup and barrel, draw a rectangle 4 in. wide by 3 in. high, and draw lines across it to cut it into 1-in. squares. Place the point of the compass on the middle of the line between two squares as indicated by the asterisk or star, and swing in a circle with a ¾-in. radius. Raise the point of the compass 5/16 in. and draw a circle that will just touch the lower edge of the rectangle. Cut four of the 1-in. squares in the lower left corner of the rectangle into ½-in. squares; then draw the pup in the squares as shown. Draw also the barrel hoops and staves.

Transfer the outline of the pattern to any thin wood and saw it out. Cut the circular hole for the napkin, but do not trim away the space between the pup's feet. After transferring the remainder of the pup's outline to the wood, enamel the barrel light brown on both sides, and color the pup white with dark brown or black spots. When this enamel is dry, transfer the stave and hoop lines of the barrel and also the features of the pup from the pattern to the enameled wood, and paint them black to make the lines stand out clearly.

To make the pattern of the clown napkin ring, draw a 4-in. square and divide it into 1-in. squares. Place the point of the compass 1 in. inside the right edge of the square and 1¼ in. above the lower edge of the square, and from this center draw a ¾-in. circle and a 1¼-in. circle. Then draw the clown as shown. When cutting the napkin ring from the wood, do not trim away the space between the clown's feet and the circle or the space at his knees. The back of the pattern is much like the face except that the large ring is completed, the cap meets the ruff over the back of the head, and the hands scarcely show.

Enamel the clown's suit white with red decorations and make the hoop blue, gilt, or green. The clown's face should be white with black lines for the features.—Hazel F. Showalter.





With napkin rings like these, children are more willing to put away their napkins neatly

Model Sail Making

***How to measure, cut, and fasten the canvas of any small square-rigged ship such as the whaling bark* Wanderer**

By
Capt. E. Armitage McCann

MANY model makers like to put sails on their models—either fully set, partly set, or all furled. To do this well requires some knowledge of sails, their build, method of rigging, and function. All the details of real sails cannot be entered into in the space available, but sufficient will be given in this and a following article to enable one to make as good model sails as is possible on a small scale.

There are thousands of different kinds of sails, but only those of the square-riggers are complicated. They likewise have varied from time to time, so it is proposed to describe in detail only those of the period from about 1850 to 1890; there has not been much change, however, from about 1830 to the present day. The difference in the earlier sails was chiefly in having less ironwork and in being baggier.

In about 1870, ships (especially British) began to use iron wire standing rigging, and about 1890 flexible wire came in for roping the heavier sails and for some of the running rigging, such as braces and halyards.

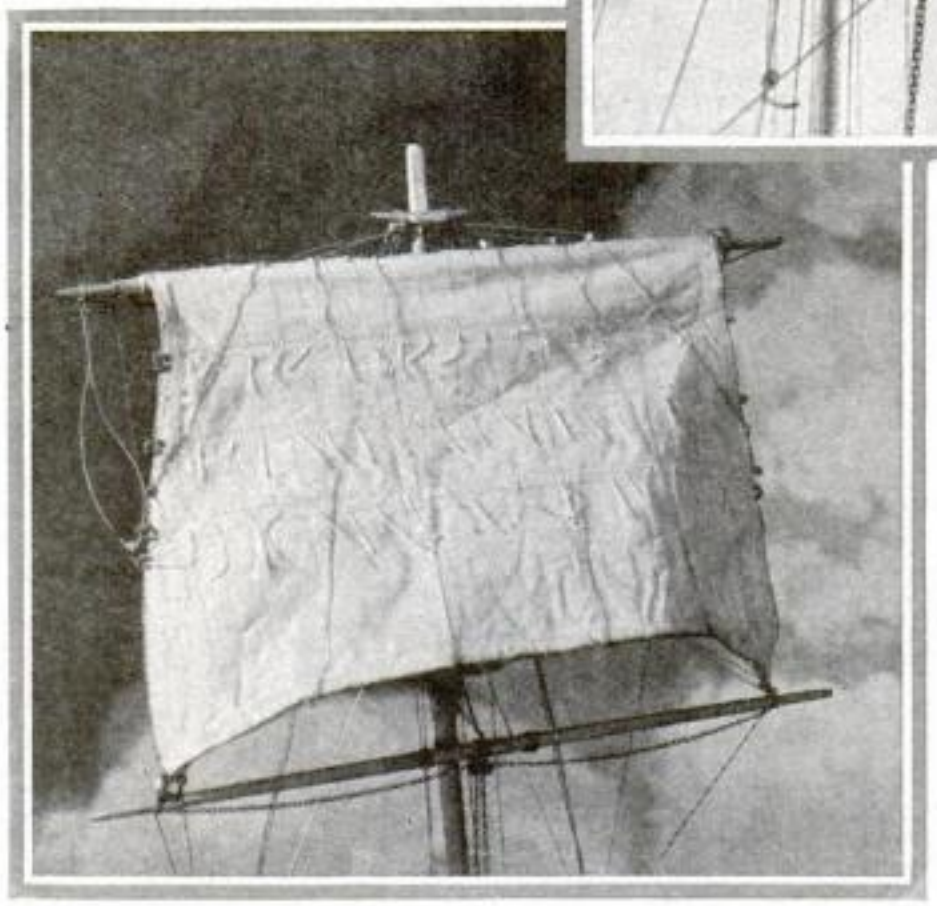
Sails may be applied in varying degrees of exactness, differing with the type of model and the scale. Decorative models such as Spanish galleons do not require much detail. The methods to be given here should be used for measuring such sails, and they should then be hemmed, roped if desired, and given a few buntlines and clew lines for effect. Then they should be hitched to the yards themselves. This is all that is necessary for that period. The clews can be lashed to the yardarms. Sails of this type are usually antiqued and bellied out stiff.

Sails for a model built to a scale less than ⅛ in. to the foot should be made of fine woven material such as bleached airplane cloth. Instead of roping, a line of flat stitching can be run where they are to be cut. Afterwards a thin line of brown (or white) brushing lacquer may be applied on the edge to prevent fraying. The selvage edge should be used for the heads.

Paper or tin sails are sometimes used. These are merely glued on and require no description.

To get the full benefit of what follows, you should send fifty cents to the Blueprint Service Department of POPULAR SCIENCE MONTHLY for Blueprints Nos. 185 and 186 (see page 96). These graphically illustrate all the details mentioned here. They are to the 1/6-in. scale and are drawn to fit the model of the whaling bark *Wanderer* (Blueprints Nos. 151, 152, 153, and 154). For a ⅛-in. scale, reduce everything one quarter, and for a ¼-in. scale, enlarge one half.

With regard to material, plain white cotton cloth will do, but I prefer a thin opaque linen because one can get it with a canvassy texture. It is worth the relatively small difference in cost.

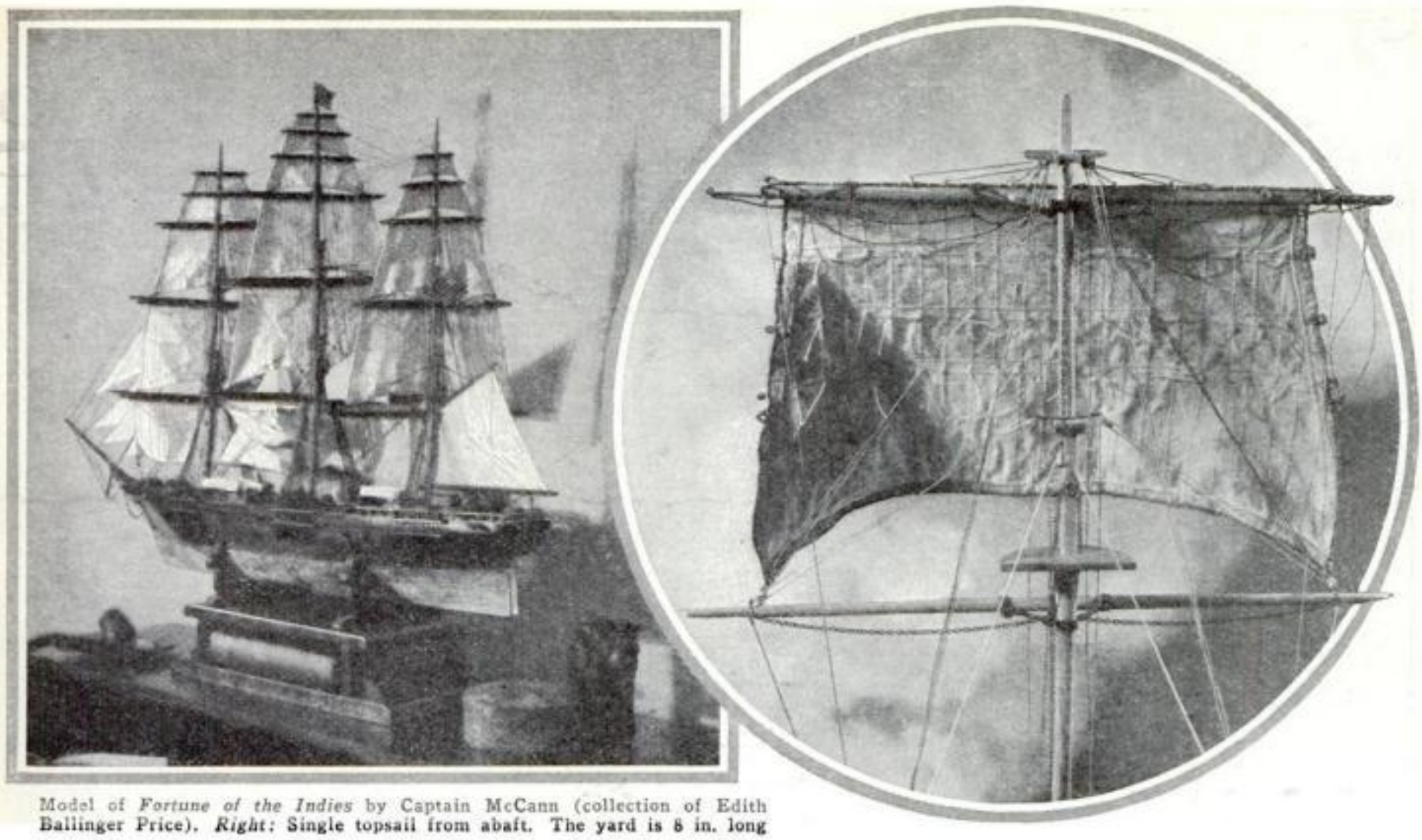


Model of fully rigged topsail with reef tackles and worked cringles on one side, half-hitch cringles on the other (main yard and top not fully rigged)

As to color, European ships use flax, which is an unbleached color when new but soon becomes snowy white. American ships use cotton canvas, which is white. A coaster may have grubby sails, but a clipper should not. The width of the sailcloths is 24 in. for flax and from 16 to 24 in. for cotton duck. The 24-in. width is shown on the plans and accompanying drawings.

To measure a sail, hoist the yard to position, measure along it from brace band to brace band for the head, then deduct about 12 in. (to the scale of the real ship, for example, 1/6 in. on a 1/6-in. scale). Measure from the top of the yard to the top of the yard below for the drop. Measure the yard below from sheet sheave to sheet sheave for the foot, and deduct 2 ft. (to scale) from each measurement to allow for the clews. Lay this out on paper, then from the foot mark the roach, or curve. This must be high enough to clear the stays passing beneath when the sail is flat on the mast. Cut out the drawing for a pattern.

Take a piece of the material and try it for stretch under about as much pressure as it will get in the making. Deduct this from the pattern. Then, in turn, allow about one in ten parts extra on the leeches and foot; this to be taken in again

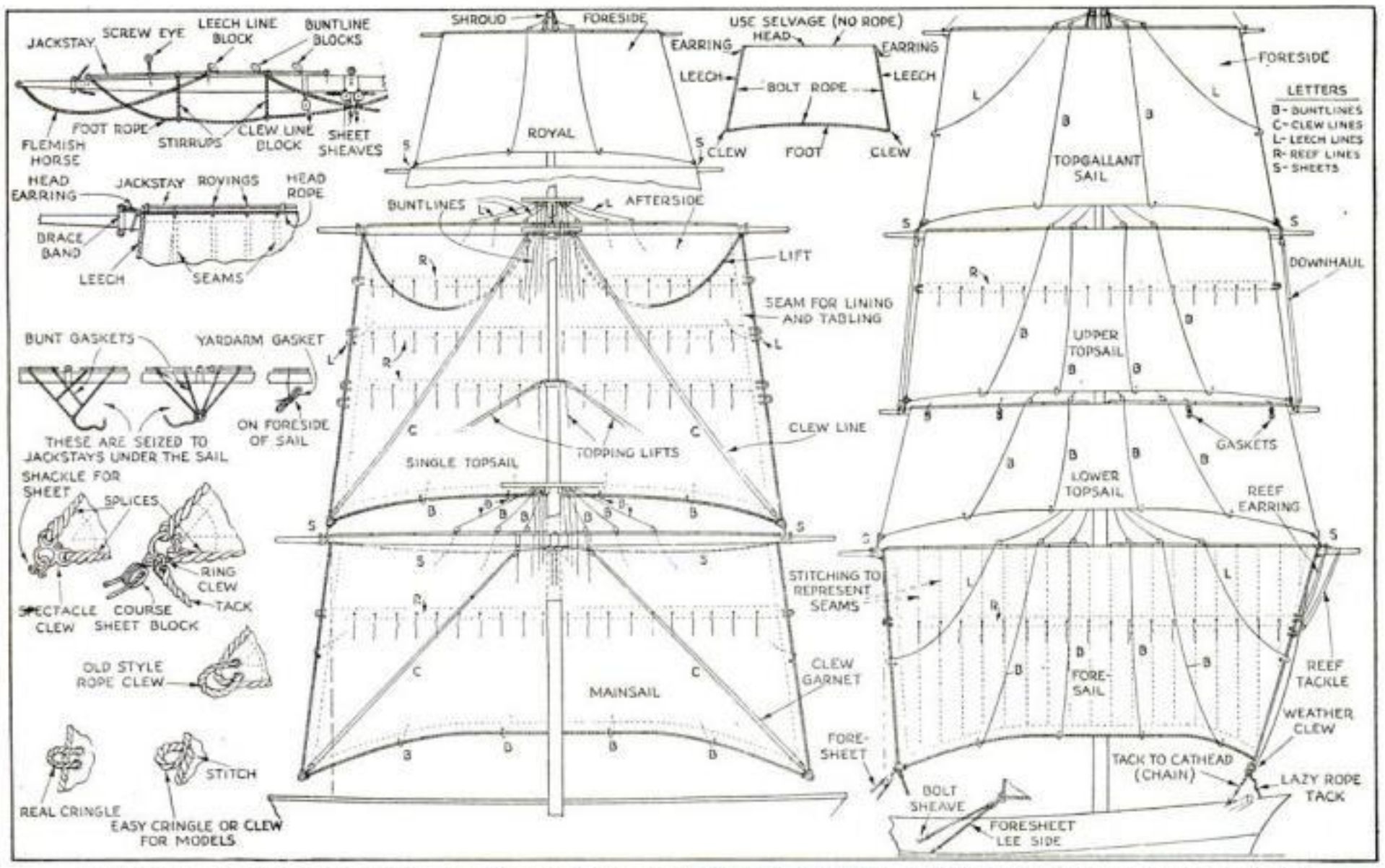


Model of *Fortune of the Indies* by Captain McCann (collection of Edith Ballinger Price). *Right:* Single topsail from abaft. The yard is 8 in. long

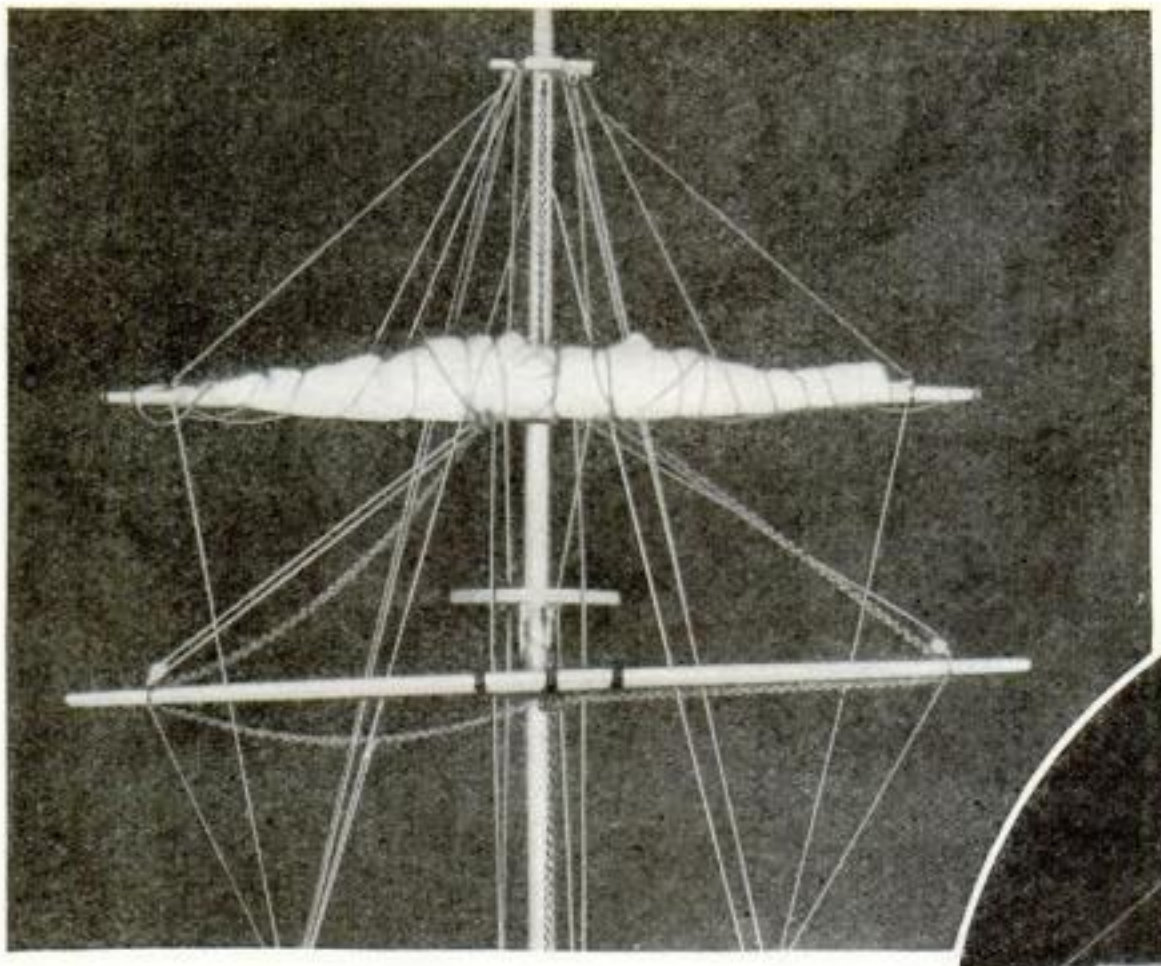
when sewing on the bolt ropes in order to give a slight belly.

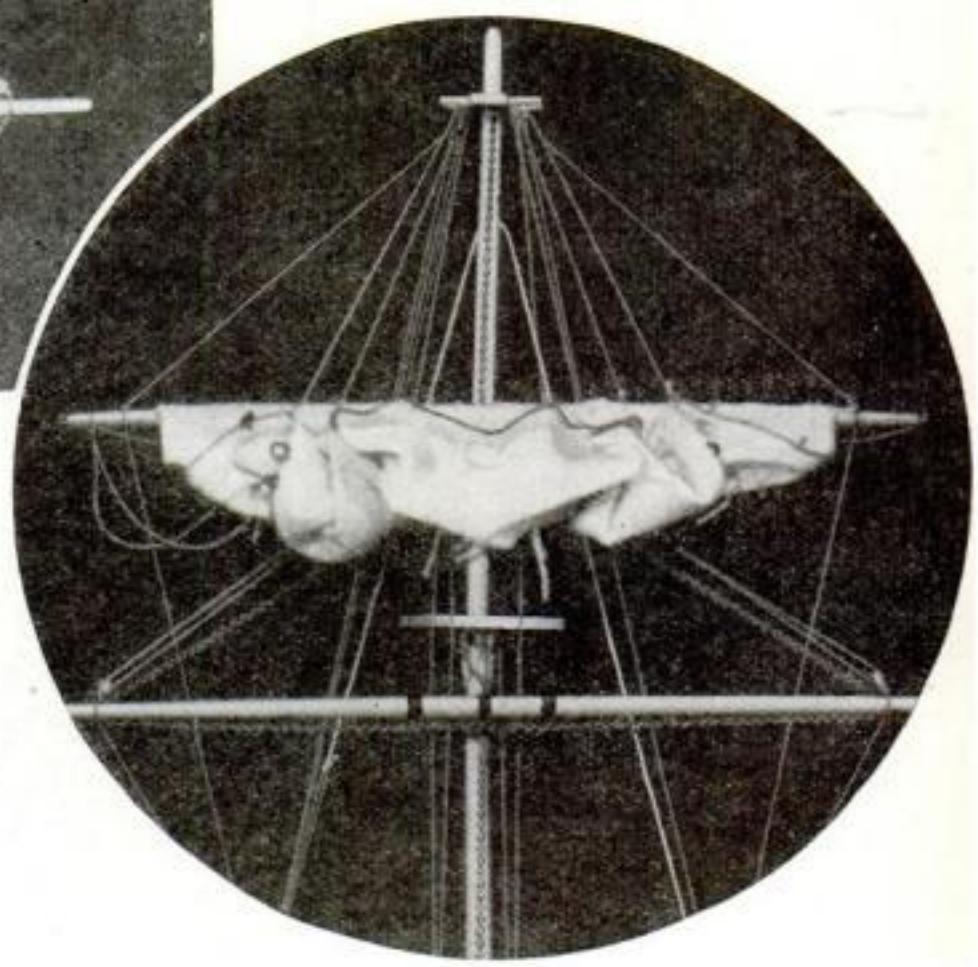
This process will apply to all the square sails for any vessel except the courses (lower sails). The depth of the foresail is to a line level with the cathead, less about 5 ft. in height; the length of the foot will be from the same point when the yard is braced "sharp up," less about 2 ft. This usually makes the sail narrower at the foot than the head. The clew of the mainsail comes to about 3 ft. from the rail at the after end of the forerigging when the yard is braced sharp up. All these measurements should be to scale, of course.

Mark the fabric from the pattern, allowing about 5/16 in. for the hem. If possible, use the selvage of the material for the head to save having a hem. Then run very thin pencil lines up and down the sails at 2-ft. intervals, and on them run rows of fine machine stitching to represent the seams. The pencil marks can be rubbed off afterwards. I give the sails a wide (half-cloth) hem to represent the lining, which is a piece sewn on for strength, the real hem being called the "tabling." I



How square sails are made and rigged. It should be noted that all buntlines, clew lines, and leech lines lead to the deck. They are for hauling up sails and therefore should be slack when set. The reef points are stitched through the sails to hang down on both sides





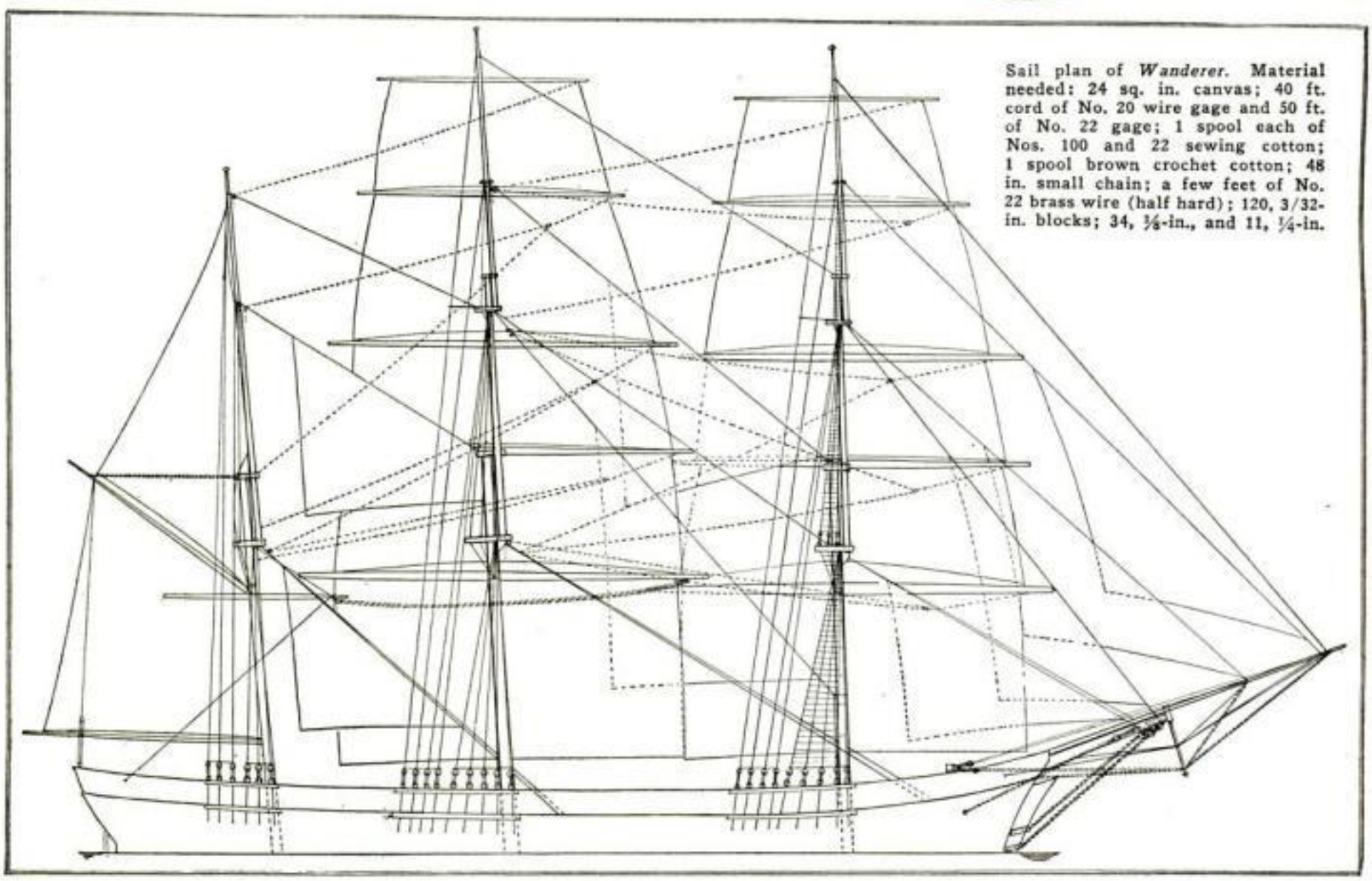
Above: The same single topsail shown in previous photos but in this case furled. *At right:* The topsail hanging in buntlines

rope the leeches and the feet of my courses and topsails with brown cord about equal to No. 20 gage wire, and the smaller sails with thinner cord. This is stitched to the edge of the sail, abaft. Cringles (side loops) can be worked with thread as shown in one detail, but are more easily and, I think, better represented by making a small bight loop in the bolt rope, as shown in another detail.

For the larger sails I make spectacle clews of wire and splice the bolt ropes into them; and for the topgallant sails and those above I stitch a bight in the bolt ropes.

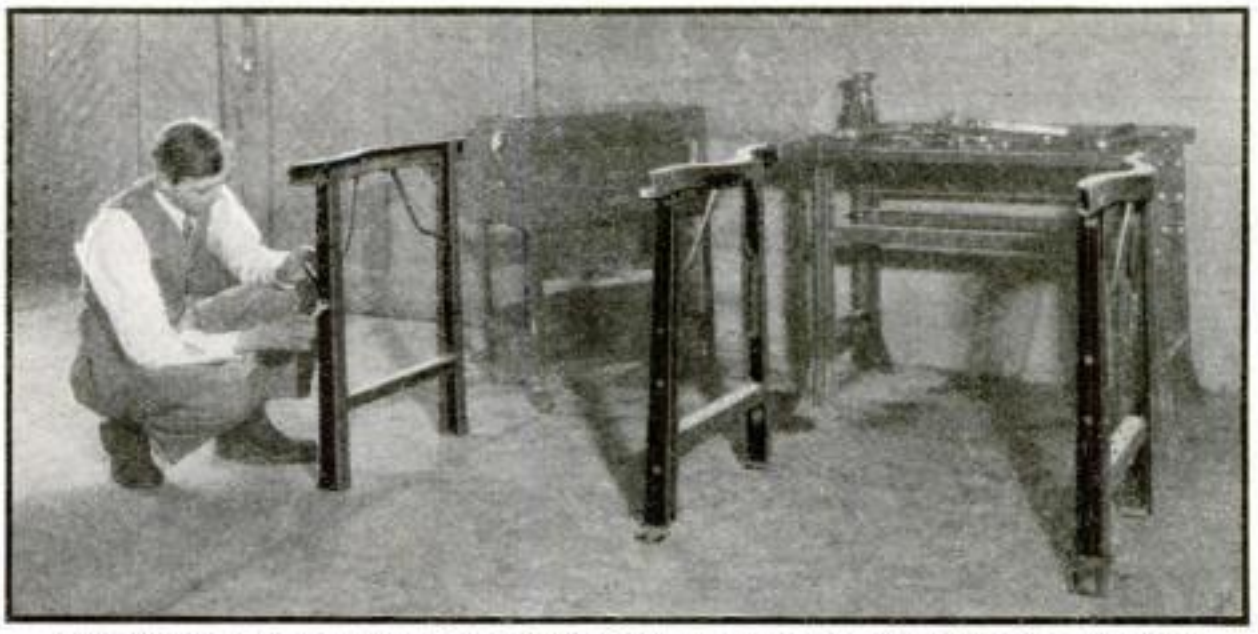
For reef bands (indicated at *R*) I make two rows of stitching half a cloth apart. For reef points a needleful of No. 24 white thread is passed through from the front to the back of the sail, then back just below, through the sail and the first part and back through the first hole, thus giving an end each side. Snip off and repeat. The large clippers usually had one reef band on the topgallant sails; single topsails have from two to four; double topsails have one on the upper topsail, none on the lower; courses have one or two.

Before the sails can be bent (fixed), a lot of blocks and gear have to be fitted. The yards must have jackstays (see detail); in fact, they should have these though there are no sails. They are 1 in. diameter iron rods fastened exactly on top of the yards with eyebolts. I make mine of No. 24 hard brass wire held in position with eyes made of ½-in. bank pins. To prevent the wire sliding out, I *(Continued on page 100)*



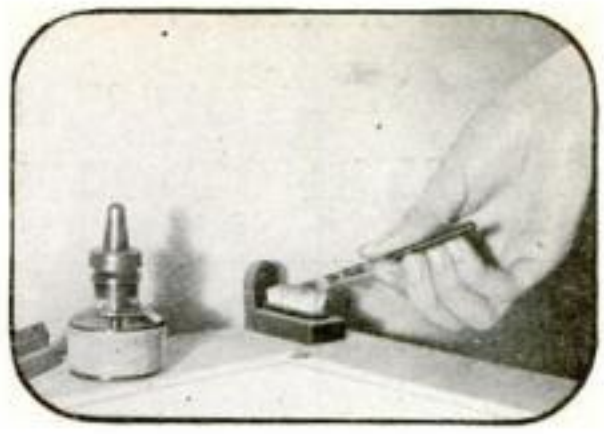
Sail plan of *Wanderer*. Material needed: 24 sq. in. canvas; 40 ft. cord of No. 20 wire gage and 50 ft. of No. 22 gage; 1 spool each of Nos. 100 and 22 sewing cotton; 1 spool brown crochet cotton; 48 in. small chain; a few feet of No. 22 brass wire (half hard); 120, 3/32-in. blocks; 34, ⅛-in., and 11, ¼-in.

OLD AUTO FRAMES BECOME BENCH LEGS



Assembling three sets of heavy-duty bench legs, the materials for which were taken from junked auto frames. The only expense was twenty-five cents for band iron used as feet

SUBSTANTIAL bench legs can be made from junked automobile frames in any shop which has the necessary facilities. The method of making such legs is illustrated in the photograph above. The pieces which run diagonally between the legs and the top cross member are running board braces. The cost of the three sets of legs shown was 25 cents for band iron used as feet. Even the bolts were salvaged. If desired, the center legs can be adjustable to fit uneven floors.—C. G. FOSTVEDT.



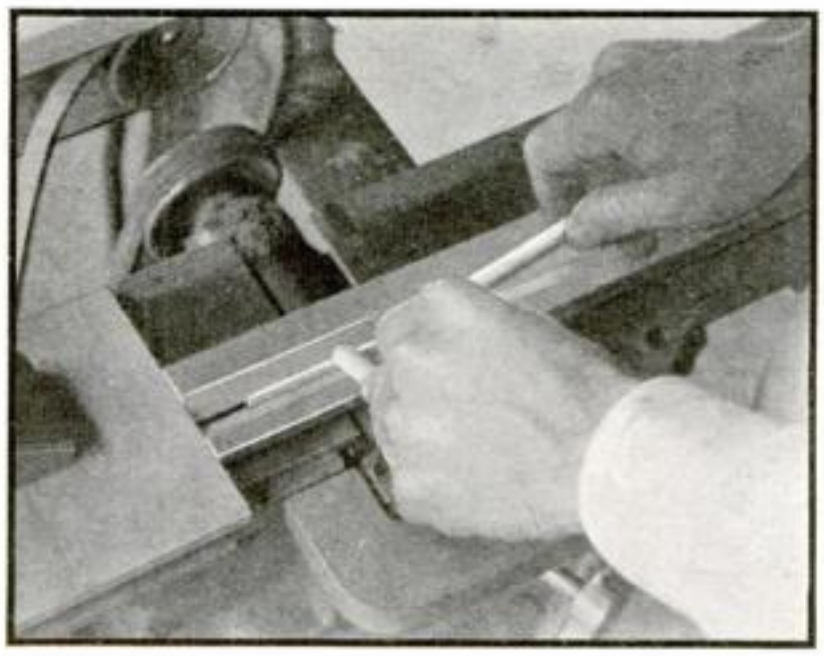
DRAFTING PENS QUICKLY CLEANED WITH BRUSH

TO CLEAN a ruling pen with an ordinary cloth penwiper takes much more time, especially if the drawing requires inks of several colors, than with the wiper shown, which was made in about ten minutes. A toothbrush with the handle cut off is mounted on a block about ½ by 1 by 2 in. On one end of the block a piece of light tin is fastened with brads to act as a spatter plate. It should stand about ½ in. higher than the top of the bristles. Into the bottom of the block a sharp steel pin is forced with the point projecting about 1/16 in. to keep the wiper in any position in which it is placed on the board.

The pen to be cleaned is drawn through the brush once or twice. Lettering pens also can be cleaned in this way without fear of injuring their delicately formed points. —DANIEL REYNOLDS.

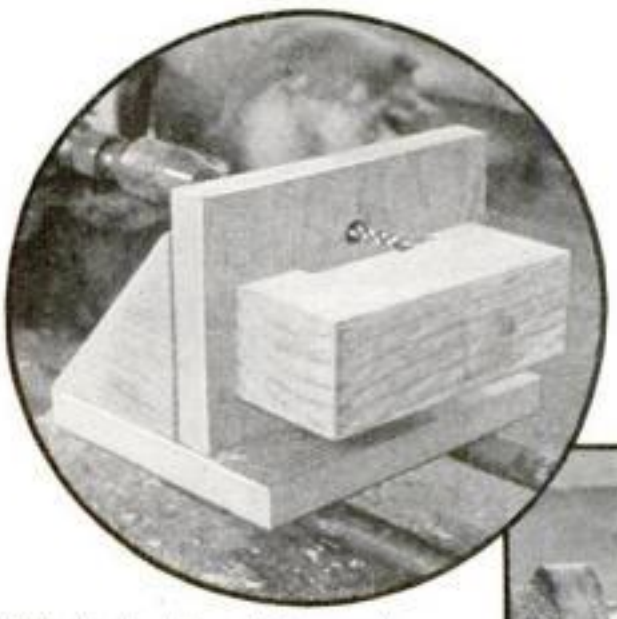
USING JOINTER TO MAKE COACH MODEL SPOKES

MUCH time can be saved in rounding wheel spokes for model coaches if a small power jointer is used. In a piece of 1-in. stock about 3 by 20 in., rip a 90-deg. V-groove 9/16 in. deep. For a distance equal to the rounded length of the spoke, joint one end on the underside until the blades show 1/16 in. wide in the bottom of the groove. Clamp the piece to the near end of the jointer; and against the other end, clamp a stop. Chamfer the spokes by resting them in the groove, pushing them and holding them down with sticks held in the hands. When the corners are planed off, it is easy to round the spokes with a file and sandpaper.—EDWIN M. LOVE.

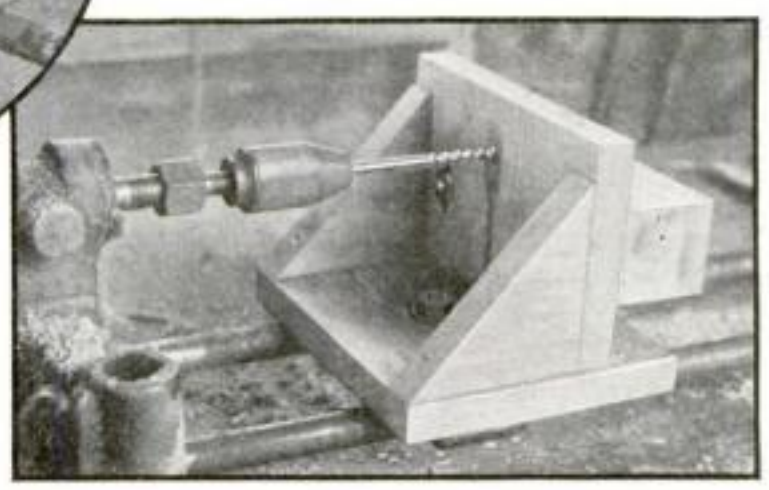


How a small bench jointer is used by Mr. Love, a noted coach model maker, to chamfer the corners of spokes that are to be used in constructing miniature wheels

HOMEMADE LATHE ATTACHMENT BORES FOR MORTISES



This boring jig, which was improvised in the absence of a suitable boring machine, is clamped on the bed of a small home workshop lathe. The parts must be square and true



The shelf on which the stock is supported can be adjusted up and down by means of screws which pass through slots in the vertical part

MORTISES can be cut with greater ease and accuracy if the preliminary holes are bored by machine. In the absence of a suitable boring machine, an attachment for this purpose can be made to fit almost any small home workshop lathe.

The device consists of a base to which is screwed a vertical faceplate, held rigidly by braces at either edge. The shelf for supporting the stock to be bored is fastened to the faceplate by two roundheaded screws, with washers beneath the heads; these extend through vertical slots in the faceplate from the rear, thereby making it possible to adjust the shelf up or down. On the inner face of the shelf is cut a recess ⅜ in. deep and 3 in. long, extending from top to bottom, through which borings fall as the bit enters the wood. Care must be exercised in mounting this device to make certain the faceplate is square with the axis of the bit both vertically and horizontally, and that the top of the shelf is exactly at right angles to the vertical faceplate.

How the device is attached to the lathe will depend upon the type of machine with which it is used; the one illustrated is clamped to the lathe bed rods. In use, the shelf is adjusted to the desired height for the mortise to be cut with the faceplate at the correct distance to regulate the depth of the hole. The stock to be bored is laid flat on the shelf in its proper position and pressed lightly against the point of the bit. When the necessary number of holes has been bored to the pattern of the mortise, the slot is squared up with chisels in the usual way.—A. V. COMINGS.

YOU CAN CONSTRUCT THIS *Fireside Bench*

so that it looks like the sturdy work of a Colonial carpenter

By DONALD A. PRICE

A handmade bench like this—or, preferably, a pair of them—will make a noteworthy addition to any living room furnished in Colonial style

BUILT of the native maple that was peculiar to Colonial New England, this fireside bench is fundamentally American in material and structure. It should be reproduced in the original maple, as that wood, because of its great toughness, is especially adapted for making mortised and tenoned joints of the type used.

The seat, marked part No. 3, should be prepared first as it will probably be necessary to glue several boards together to make up the required width of 15 in. If means are not available in your own home shop to make a strong type of joint, have this work done at the mill as a good, solid plank is essential for the seat. In building the bench illustrated, a shaper head was used on the circular saw to give an interlocking V-joint.

The cleats, part No. 4, should be screwed and glued to the bottom of the seat. Sink the heads of the screws about ⅜ in. below the surface of the cleats and conceal them with dowels glued in and dressed off flush with the surface. Take pains to locate the two screws at the rear edge of the seat not more than ½ in. from the end of the cleat so that the mortise for the back posts will clear these screws.

To make sure that all the legs will have a uniform slant, it is necessary to make up a boring jig such as illustrated at *A* in the drawings. It is made of rather heavy wood, 1½ in. or more thick. Two pieces of the same size are required, held together with through bolts. In the meeting faces of each piece are sawed grooves 1½ in. wide and ¾ in. deep. These grooves are placed at an angle of 68½ deg. to the bottom edge. When the parts are clamped together, a square hole is formed to guide the bit. This jig is then clamped on the top side of the seat as indicated at *B*. It should have its center line at 45 deg. to the edge of the seat and, of course, be located so that the bit will start the hole for the legs at the correct position as shown on the drawings. The operation of boring the hole is shown in one of the photographs. It is necessary to have a sharp bit, preferably one with a fine thread at the point, to avoid splintering the edges of the hole when entering and leaving the wood. The screw point on the bit may prove to have too coarse a thread for boring in maple; at least, this was the author's experience as the only bit of the necessary size he had available was a ship auger. In this case, after the bit was well started into the wood, it was removed and a 3/16-in. lead hole was drilled through the part with a twist drill, care being taken that the proper angle was maintained. This allowed the screw point on the auger to slip, and although greater pressure on the brace end was necessary, the boring was successfully completed. If the hole is found to be rough, it can be cleaned up with a piece of coarse sandpaper wrapped around a round rod about 1⅜ in. in diameter. In sanding the hole, widen out the top of it slightly in the direction of the slant to allow the split ends of the leg to be locked in with a wedge.

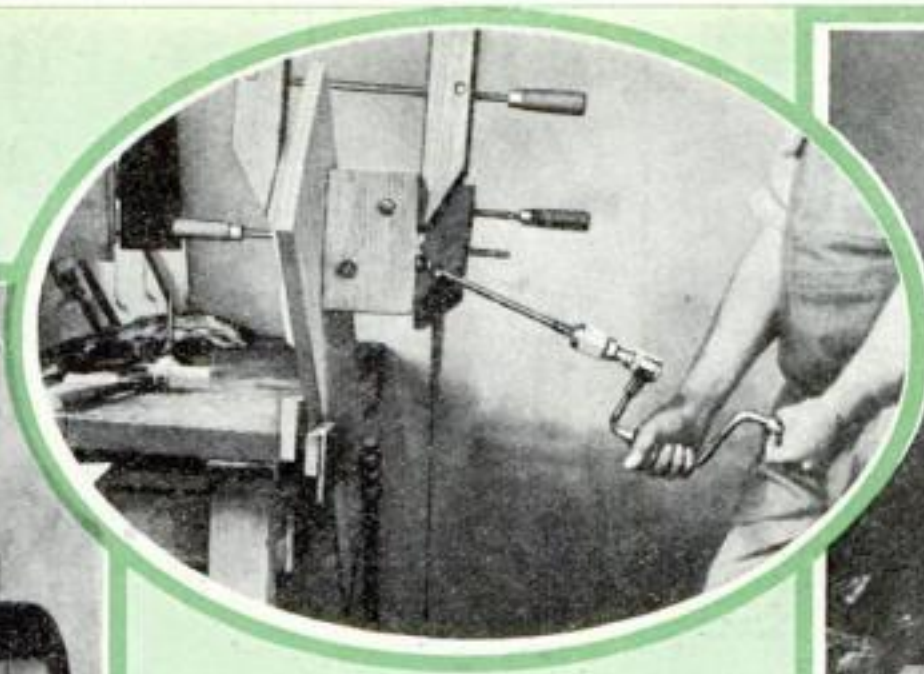
The legs should be turned to the size shown in detail drawing *C*. Fit the 1½-in. diameter in the hole in the board as it may be found that the hole is not exactly true to size. Leave a slight taper on this leg where it enters the lower side of the cleat so that, when driven into place with a mallet, it will be firmly seated.

The bench is an accurate copy of one constructed by some village joiner in New England before the Revolution. Like the original, it is constructed of maple, a wood now extremely popular

The final assembly of the legs in the seat is done with glue. A wedge 1 in. long having a taper of about 1/16 in. is driven into a saw cut in the top of each leg as detailed at *D* and illustrated in one of the photographs. Of course, the legs should not be permanently fastened in the seat until the mortise for the back post, part No. 2, has been cut.

The back rail, No. 1, and the two back posts, No. 2, should be finished as shown on the drawings and permanently assembled before cutting the mortises in the seat for the back posts. Any slight misalignment of the tenons on the lower ends of the back posts may then be allowed for. The mortises should be excep-

At the right is illustrated the method of boring the holes in the seat at the correct angle to receive the tenons on the legs with a boring jig made in two parts as shown in the detail drawing *A* at bottom of page



When the scrolled edges have been cut out, they can be sanded most easily by using a band saw sanding belt as shown at the left. The photograph at the right is a suggestion on how to drive the wedges into the legs

tionally close fitting. They are to be glued and pinned together with ⅜-in. dowels as shown. These dowels or pins are dressed off flush with the surface.

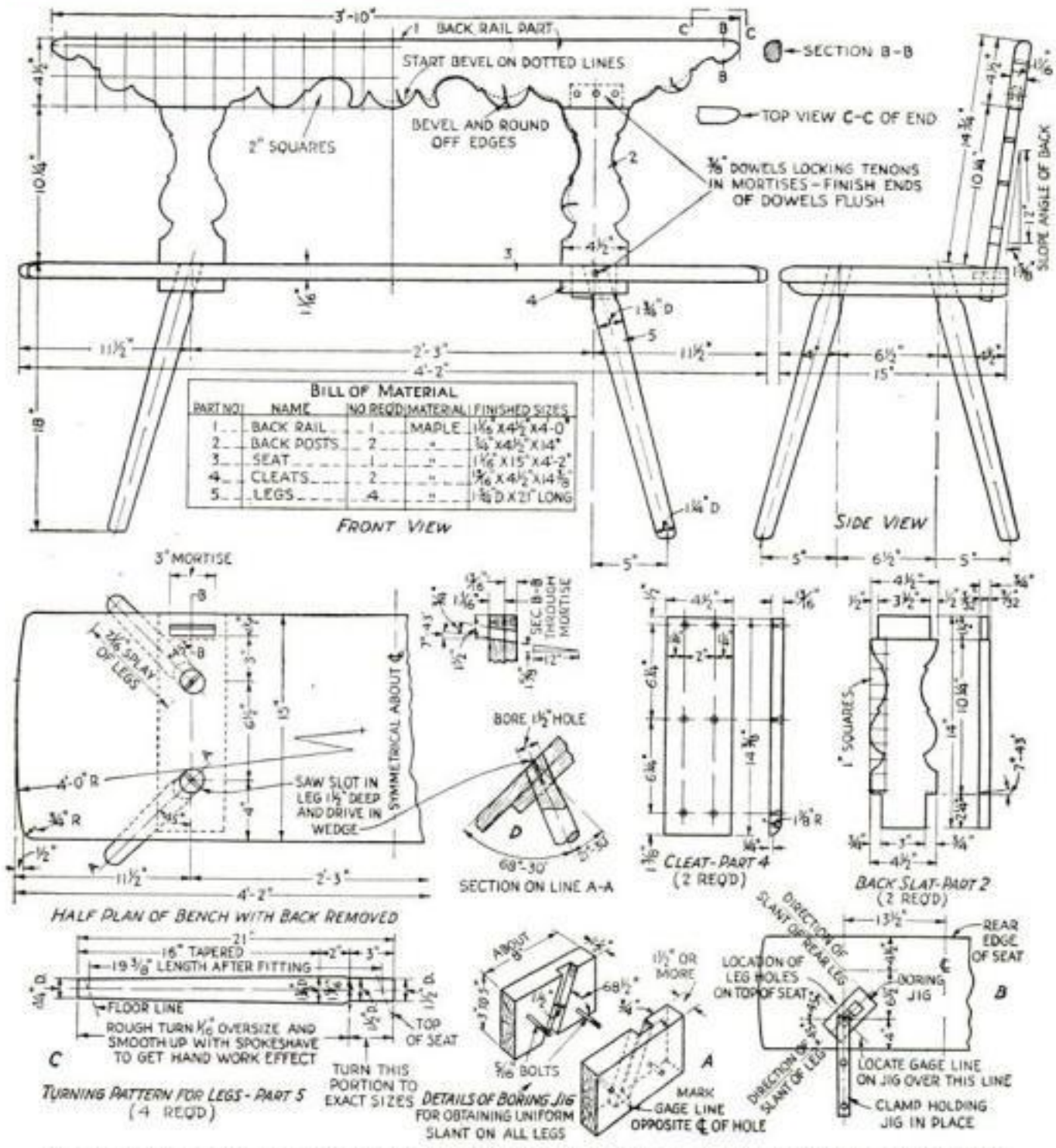
In order to simulate an appearance of wear on the original piece, a wood rasp and coarse sandpaper may be used to bevel and round off all edges. On the sharper corners of the projecting parts of the design, the wear naturally would be greater, and the bevel should be started correspondingly farther back from the edge. Upon the care with which this particular part of the work is done depends most of the charm of the finished bench. A visit to a museum showing real antiques would be profitable in this respect. If this is not possible, it is suggested that the prospective builder examine some of the better grade of antique reproductions that can be seen in most of our larger and higher class department and furniture stores.

After the bench has all been put together, the legs, which were left longer than necessary, must be cut off to give the proper seat height. This may be done in the usual way by blocking the seat up on a level surface so that it is a uniform height, say 20 in. from that surface; then, with the aid of a 2-in. block of wood and a pencil, scribe a line around the legs 2 in. from the working surface. Cut off the legs on this line and round the corners to a generous radius as shown in the drawings.

On the original bench from which this design was adapted, the seat is absolutely level as has been shown in the drawings; however, cutting an inch off the rear legs so that the seat slopes backward will make the bench more comfortable for the average person to sit on.

Probably the most realistic finish would be to give this bench a maple acid stain followed with a sealing coat of thin shellac, and then several well-rubbed coats of hard furniture wax.

Large blueprints of this bench can be obtained from the Blueprint Service Department for seventy-five cents. Ask for Special Blueprints Nos. 187A and 188A. A coupon for your convenience in ordering is given on page 96.



Front and side views of the bench; a half plan view with the back removed; details of legs, cleats, back slats, and the slotted two-part boring jig; and a list of materials giving the finished sizes

Adding the Deck *and* Cockpit Fittings *to Our New* *Sportboat*

This smart looking runabout is 15 ft. 6 in. long and has an extreme beam of 5 ft. 3½ in.

IF YOU are building the new POPULAR SCIENCE MONTHLY "sportboat" and have carried the construction to the point described in the preceding article (P.S.M., July '32, p. 67), you are ready to remove the hull from the form and turn it right side up. You will now be able to see the trim, shipshape lines to better advantage and visualize how the finished boat will look.

The most noteworthy feature about the "sportboat" is the way in which the comfort and roominess of a small cruiser have been combined with the smart appearance and speed of a runabout. This was pointed out last month, but if you missed that issue and desire to own a boat of this especially useful type, it will pay you to look up a copy of the July magazine and also to send 75 cents for POPULAR SCIENCE MONTHLY Blueprints Nos. 175, 176, and 177 (see page 96). To make the work still easier, full size patterns have been prepared and will be sent with the blueprints for $2.25.

The next step in the construction is to set in place the forward and after deck and cockpit beams. Fasten the beams to their respective frames with one 1½ by ¼ in. carriage bolt at each joint. Lay a light batten over deck beams Nos. 1, 2, 3, and 3½ and measure for the intermediate beams. Fasten the intermediate beams midway between the deck beams with one 2½-in. No. 10 F. H. screw driven through the top edge of the planking and inwale. The motor pit sidepieces are fastened to the transom and the intermediate beam with two 2-in. No. 10 F. H. screws to a joint. Square the ends of the coaming supports so that the coaming, when attached, will be perpendicular. This is easily accomplished by laying a ¾-in. piece across from sheer to sheer. Place a square on this piece alongside the cockpit beam and mark the ends of the supports.

The breasthook is fastened in place with six 2-in. No. 10 F. H. screws. It is slightly crowned so that it follows the curvature of the deck beams. A light batten placed over the deck beams and breasthook will show when it is correctly crowned.

Notch the carline flush into the breasthook, deck beams, and coaming supports, and halfway into the transom. Fasten each joint with one 1¾-in. No. 8 F. H. screw.

The coaming blocks are notched to fit flush with the coaming supports, and fastened to the carline with 1¼-in. No. 6 F. H. screws spaced about 4 in. apart. These blocks support the sedan top.

The seat riser is butted against frame No. 4 and fastened to each frame with one 2-in. No. 10 F. H. screw.

Start attaching the floors at frame No. 9. Fit the first floor so that the bottom of frame No. 9 is level. The floor at frame No. 3 is next fitted level. To level and attach the remaining floors, fasten a string from No. 3 floor to No. 9 floor on each side. Bring the remaining floors up until they touch the strings. Fasten floors to frames with 1⅜-in. No. 8 F. H. screws.

At this point it is a good idea to apply linseed oil thinned with turpentine, or a prepared primer, to the inside of the hull. When this is dry, apply two or three coats of varnish or paint. Allow sufficient time for drying. Be sure to varnish or paint the inside before the flooring goes on.

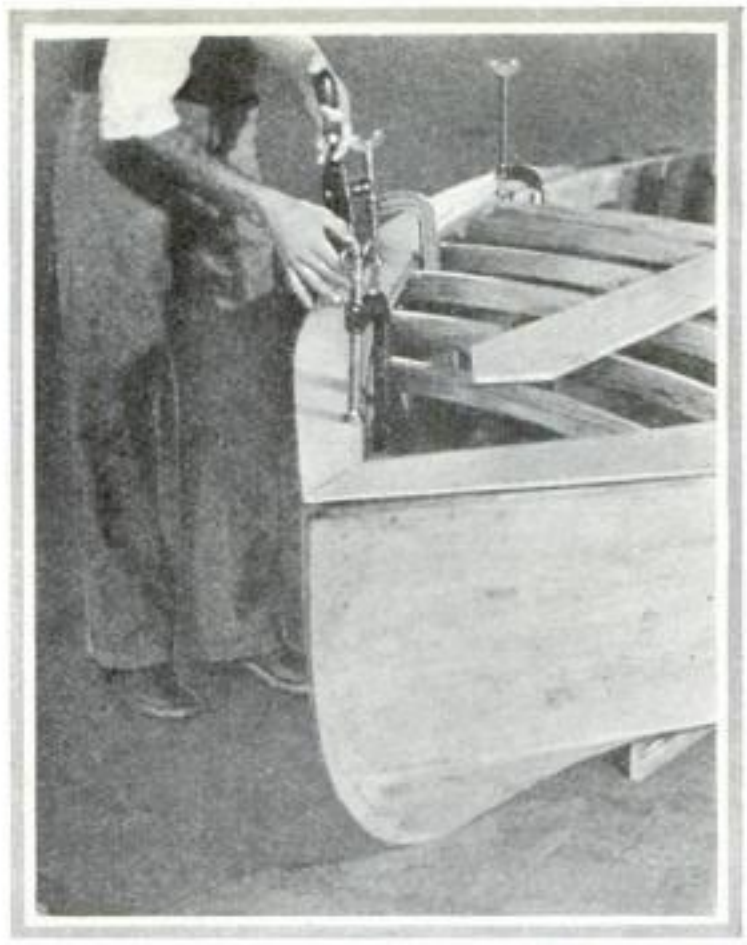
The plank-sheer and decking are next cut out. Clamp the plank-sheer material in place so that it covers

How the deck beams, intermediate beams, motor pit sidepieces, coaming supports, carlines, and seat risers are added to the hull

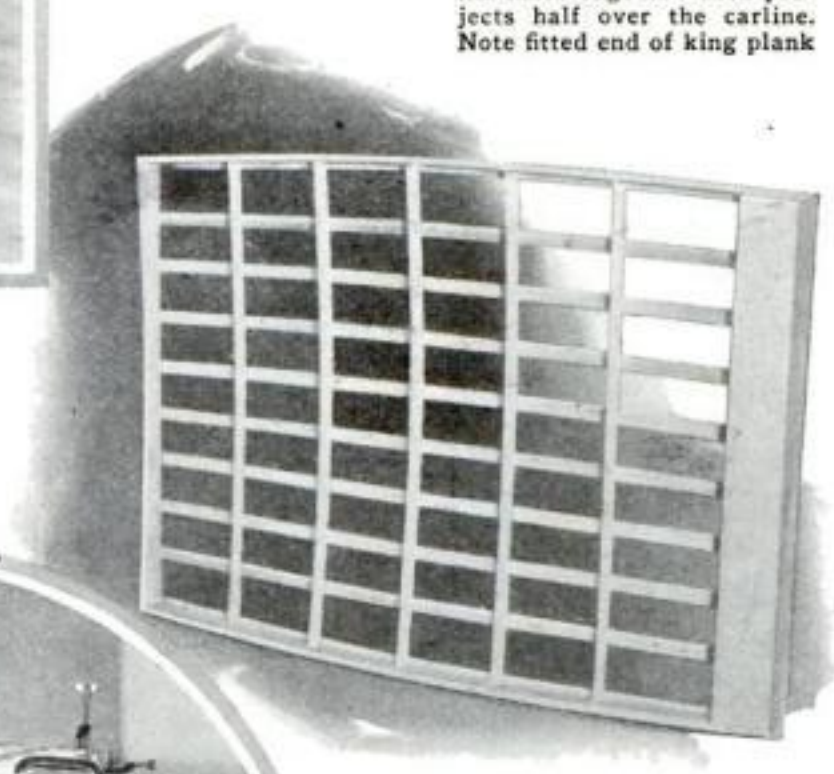
The photograph in the square above shows beams, breasthook, and carlines from the bow

• • • A fast, roomy 15½-foot runabout of advanced design with removable top, seats that become bunks, and other conveniences

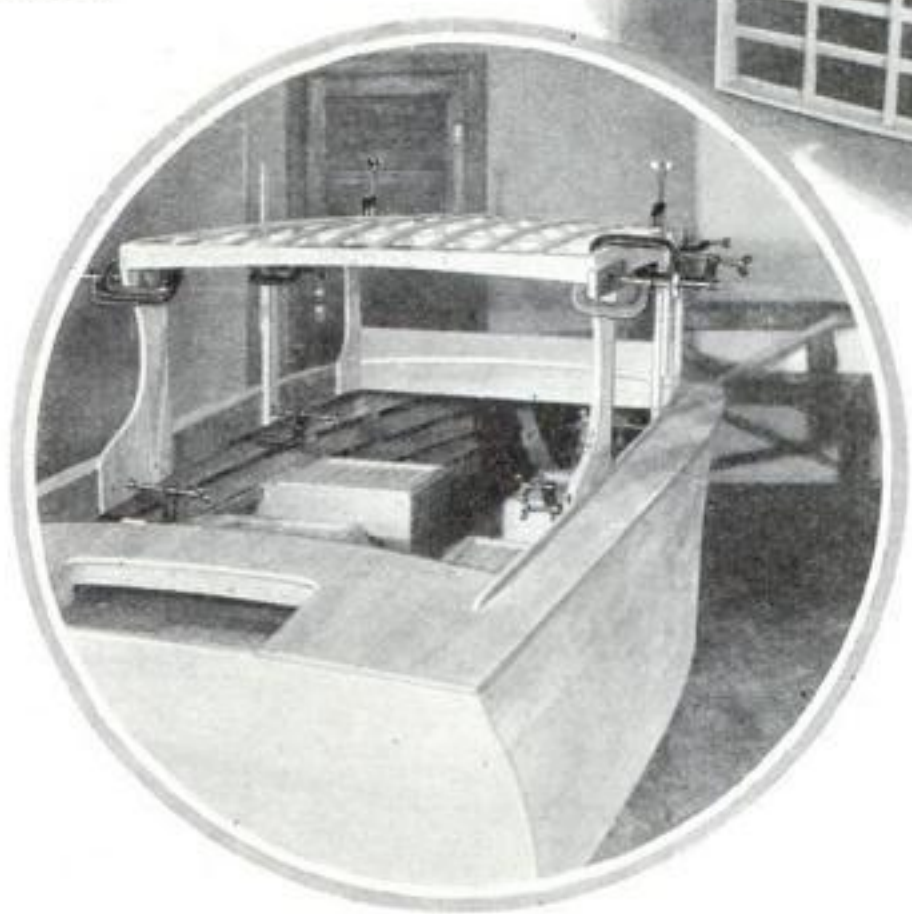
By WILLIAM JACKSON



Applying the plank-sheer, the inner edge of which projects half over the carline. Note fitted end of king plank



The top edges of the boxlike seat frames are fitted flush with the seat risers. The seats themselves are frames of 1-in. material covered with chicken wire, padding, burlap, and imitation leather



The view above shows construction of the top, which it is best to build right on the boat. It is later covered with canvas, cotton batting, and imitation leather. The photograph at the left is of the top in position

as much as possible of the carline and sheer. Mark around the outer edge of the sheer and the inner edge of the carline. With the plank removed, add to the carline line one half the width of the carline so the edge of the plank-sheer will come in the center of the carline. It will be necessary to butt the plank-sheer abaft frame No. 4 and continue out to the transom with another piece. A block ½ by 4 by 8 in. is used where the plank-sheer pieces butt together.

The after edge of the king plank fits flush with beam No. 3½. The forward end is fitted to butt against the two ends of the plank-sheer. In the same manner, mark and saw out the afterpieces of the plank-sheer and king plank.

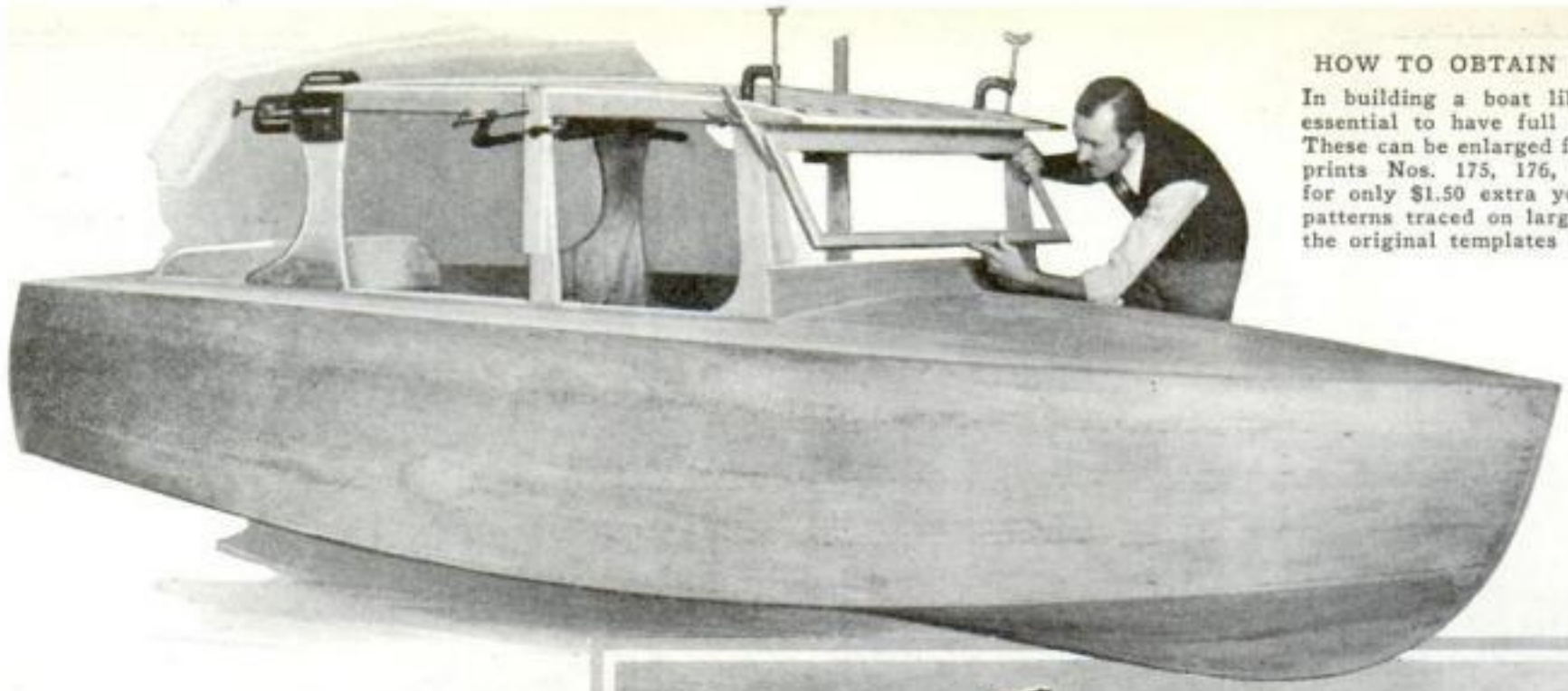
The decking is fitted so that the forward edges butt against the plank-sheer and rest upon the carline. The after edges are sawn flush with deck beam No. 3½. Plane the edges of the fore and aft decking so that it is tight on the inside edge and open about ⅛ in. on the outside. These seams are afterward filled with white seam filler, making a pleasing contrast with the varnished deck. The 6 in. wide deck boards are grooved in the center so as to represent seams.

To make a neat job of the deck and plank-sheer fastenings, especially if the deck is to be varnished, the screw holes should be plugged. For this purpose obtain a ⅜-in. bit of the Forstner type and ⅜-in. wood plugs of the same kind of wood as the decking. The lead holes for the screws should be drilled 2½ in. apart; then with the ⅜-in. bit cut a circular hole about ⅛ in. deep directly in the center of the lead hole. The 1¼-in. No. 6 F. H. screws are next inserted into the small lead holes. Coat the wood plugs with waterproof colorless glue such as some of the special marine glues, and drive the plug into the hole. Insert so that the grain in the plug follows the grain in the decking. After the glue dries, carefully chisel the plugs flush with the deck.

The entire deck forward and aft is then planed and sanded smooth. Of course, if the deck is to be painted, it will be necessary merely to countersink the screws slightly and use putty. The deck may then be covered with canvas.

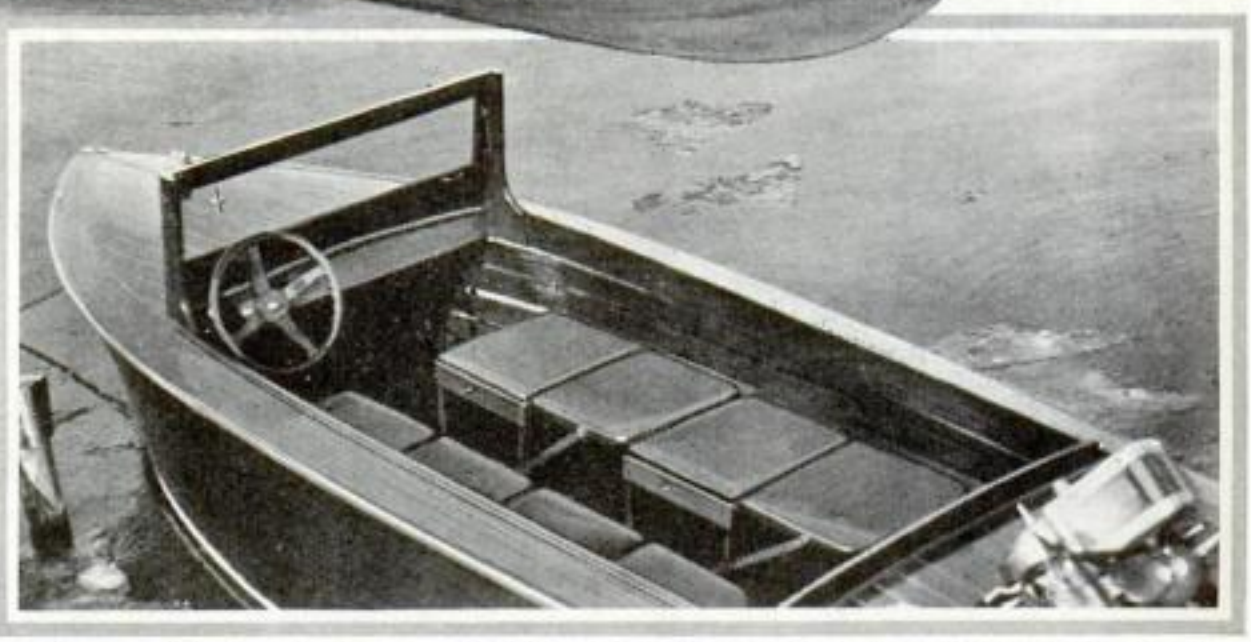
Fasten the flooring to the floors with 1¼-in. No. 6 F. H. screws spaced about 2 in. apart. Leave the center floor board loose so that it may be removed. The outer pieces of the flooring fit against the side members of the frames.

Attaching the coaming is the next step. Fit its forward edge against beam No. 3½. Let about 1½ in. of the coaming project



HOW TO OBTAIN PATTERNS

In building a boat like this, it is essential to have full size patterns. These can be enlarged from our Blueprints Nos. 175, 176, and 177, but for only $1.50 extra you can obtain patterns traced on large sheets from the original templates (see page 96)



The "sportboat" with top removed. The seat backs have been turned down to show how bunks are made up when the boat is used for cruising. *Above:* Fitting the windshield

above the plank-sheer. The afteredge is fitted against beam No. 9. At this point allow about 10 in. of the top edge to extend. This should be shaped off properly. The fastenings for the coaming are to be plugged the same as for the deck. Fasten the coaming to the carline, coaming blocks, and coaming supports with 1¼-in. No. 6 F. H. screws spaced about 6 in. apart.

The windshield deck piece, windshield stanchions and toppiece are next fitted and fastened. The bottom edge of the windshield stanchion fits flush with the coaming. Let the stanchion project out over the deck ¾ in. From the blueprints you will see that the stanchion is mortised ⅜ in. deep. The mortised side is to fit against the coaming. Fasten the stanchion to the coaming with five 1½-in. No. 8 F. H. screws. The windshield toppiece is now mortised properly and fastened to the stanchions with two 1¼-in. No. 6 F. H. screws at each joint.

The windshield coaming piece is beveled correctly and fitted to follow the curvature of the deck at this place. The end of the coaming piece fits flush with the outside of the stanchion. Fasten the coaming piece to the stanchions with three 1½-in. No. 8 F. H. screws to a joint.

The joint on the inside, between the coaming piece and the edge of the deck, is covered with a ⅜ by 1 in. strip fastened with 1¼-in. No. 6 F. H. screws.

If an outboard motor is to be used for the motive power, the opening for the motor is now sawn in the transom. The blueprints give the correct size. A motor board made as shown is fastened to the transom with 1⅝-in. No. 8 F. H. screws.

Fasten the transom knee in place with two 6 by ¼ in. carriage bolts and four 3-in. No. 10 F. H. screws.

Building the combination seats and bunks is the next undertaking. These are 1 by 4 in. frames, covered with the ⅜-in. sheathing material. Fit the top edge of the seat frame flush with the seat riser. A third outer end piece joins the two side members of the frame together. The outside ends are supported by 2 by 4 in. uprights or legs. Fasten the frames and uprights together with 1½-in. No. 8 F. H. screws. The 1 by 4 in. rear seat frames extend from side frame to side frame. Fit these flush with the seat riser, and fasten to the sides of main frames with 1½-in. No. 8 F. H. screws. Fasten center supports to frames with 1-in. No. 8 F. H. screws.

The ⅜-in. seat sheathing is fitted and fastened to the seat frames with 1¼-in. No. 6 F. H. screws. Let this seat sheathing project ⅜ in. above the seat frames to prevent the seats from slipping out of place. After the sheathing is attached, ⅜ by 2 in. strips are nailed to the large after-seat sheathing with 1½-in. finishing nails to give a paneled effect.

If desired, the upholstering of the seats and the seat backs may be dispensed with, and the seats merely varnished. In this case the seat bottoms are constructed from ¾-in. material. If the seats are upholstered, make the seat bottoms with a 1-in. frame. Nail a cover on the bottom of ¼-in. plywood. The top of the seat frame is covered with chicken wire fencing stretched tightly and tacked to the frame. The wire fencing has resilient qualities that are comparable to small springs. The seat backs are fitted so that when they are folded back, one edge rests upon the edge of the other seat.

The inside sheathing is fastened to the side members of the frames with 1-in. copper wire nails. The sheathing extends from frame No. 9 to frame No. 2. Separate the edges of the sheathing about ½ in.

The center and after stanchions are now constructed from the blueprints and laid aside for the time being.

From a study of the photographs and plans, you will see that the top is very simply constructed. The first step is to saw out the stringers, end piece, nose piece, and forward beam. Clamp the after stanchion and center stanchion in place. As there will be some variations in individual boats, it is well to construct the top right on the boat. Clamp the stringers in position, allowing 6 in. of the forward ends to project over the windshield.

The forward beam is next fastened to the stringers directly over the windshield with two 1-in. No. 8 F. H. screws. The top end piece is now fastened to the after end of the stringers with 1¾-in. No. 8 F. H. screws. Clamp a ¾-in. piece across from stringer to stringer, spreading the stringers to their proper width. Be sure the center and after stanchions are perpendicular. The plans give the height of the beams, and it is an easy matter to measure across at the proper points and obtain the width of the beams. Fasten each beam to the stringer with 1¾-in. No. 8 F. H. screws, one to each joint.

The nose piece and visor piece are now fitted and fastened. A ⅜ by 1 in. nailing piece is fastened with 1¼-in. No. 6 F. H. screws 5/16 in. below the top of the end piece. The ends of the battens are nailed to this piece. Space the top battens equally and nail them to the beams with 1-in. copper nails. The after ends of the top battens fit flush with the end. The forward ends are beveled out to nothing and nailed to the nose piece.

The windshield frame is cut to fit. Mortise the frame together and glue with waterproof casein glue. Rabbet the inside ⅜ in. deep and ⅜ in. wide for the windshield glass. The glass is fastened in the rabbet with ¼-in. three-quarter-round molding held with ¾-in. brads.

Fasten ⅜-in. quarter-round molding with 1-in. brads along the outside of the coaming, afterdeck edge, and across the front of the *(Continued on page 100)*

HOW TO COVER MODEL AIRPLANE WINGS

Pins are driven slantwise around the edges of the wing to prevent it from being warped

ONE of the most difficult problems of model aircraft construction is the warping of the wings when the "dope" is applied. To prevent this I use a hinged support or mold to keep the wings in shape while drying, and they usually stay that way for a number of flights.

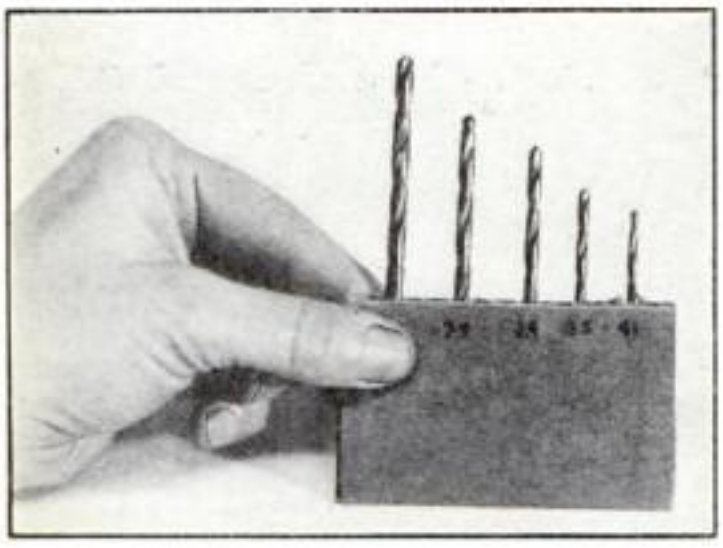
Plane and sandpaper two white pine boards ¾ or ⅞ in. thick and about 2 ft. long (or a little more than half the length of wing you intend to make) and hinge the pieces together. Measure about 4 in. back from the hinged edges on the side opposite the hinges and taper off to about ¼ in. thick at the joint as shown. This takes care of the flat surface in most wings where they are attached to the fuselage.

Assemble the spars and ribs in the usual way. Lay out the required dihedral and tack a thin strip along the edges of the jig to hold its two halves at the correct angle. Place both halves of the wing on the form and cement together. Set ordinary pins at a slant into the board around the edges of the wing to hold it down till the cement dries. If wire loops are used to attach the wing to the fuselage, simply drill holes where they come in contact with the board.

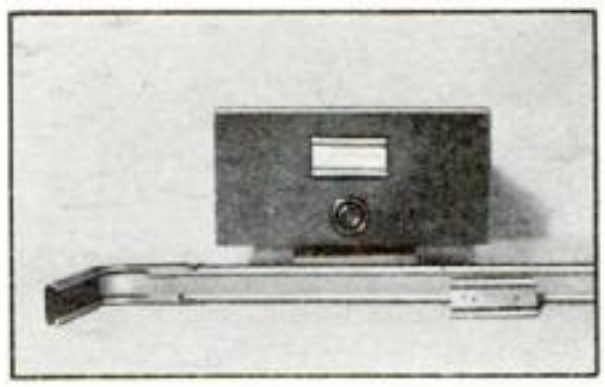
Remove the wing, turn the hinged board over, cover the wing on the bottom only, and fasten it to the mold with pins as before. Using a soft brush, paint the tissue paper with water to shrink it. When dry, apply the required amount of dope, but be sure the pins are still holding the wing down on the mold. After the bottom is dry, remove the wing, turn the mold over again, and repeat the covering process on top of the wing. A small block of wood can be placed underneath the leading edge of one wing to warp it sufficiently to counteract the twisting torque caused by the revolving propeller when the model is in flight.—LINN G. DUNCAN.

The completed wing entirely free from distortion, and, above, cementing the two halves of the framework

CORRUGATED CARDBOARD HOLDS DRILLS



A SMALL square of corrugated cardboard will be found handy for keeping small drills together in the tool chest or workbench drawer. The drills are thrust into the corrugated channels, where they remain in plain sight, ready for instant use. If a large number of drills are on hand, several pieces of the cardboard can be arranged in a small rectangular box, or a larger piece rolled up and placed in a small round tin or cardboard container. Another shop use for corrugated cardboard is as a backing for sandpaper.—R. W.



CURTAIN RODS PROVIDE NEAT LABEL HOLDERS

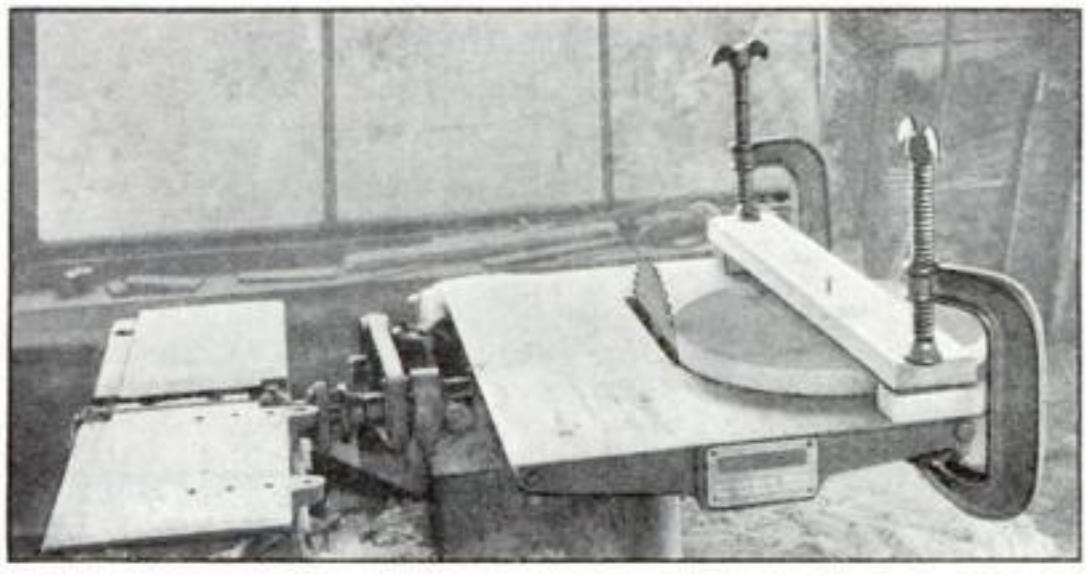
AN EASY way to make label holders for drawers, boxes, and filing cases is to cut a curtain rod of the type shown above into lengths of about 1½ in. Use a fine toothed hack saw for this. Holes are then drilled or punched through the back for screws or brads with which to fasten them in place. If the drawers or boxes are of metal (see P.S.M., May '32, p. 80), solder can be used. These holders are economical, as there is material for about twenty-two in a rod costing ten cents.

If a piece of celluloid the same size as the labels is slipped in over each of them, it will prevent their becoming soiled. Scrap celluloid for this purpose may be obtained, usually for the asking, at any garage where side-curtain work is done. Strips of cellophane glued to the labels can be used as a substitute for the celluloid.—D. R.

CUTTING DISKS ON A CIRCULAR SAW

IF A BAND saw is not available, it is possible to cut a disk of wood quite accurately on an ordinary home workshop circular saw. To accomplish this, describe a circle of the size desired on the board and trim the board roughly to within ⅛ in. of the mark. This may easily be done by a series of straight cuts. Next, clamp a "bridge" of 1 by 3 in. pine across the saw table top as shown with fillers at either end so that the rough-sawed disk will slip beneath it easily. Drive a nail down through the bridge about opposite the front edge of the saw blade and into the exact center of the disk. Then adjust the clamps until the saw cuts exactly on the line, and revolve the disk by hand against the saw for one complete revolution.

This method may be used for cutting a disk of almost any size. If it is so large that the center falls beyond the table top, a suitable support may be clamped to the bench at the required distance, and a nail driven through the center of the disk into this. Plywood and wall board may be cut into disks of considerable size in this manner. Do not force the saw, however; allow it to cut slowly.—A. C.



A band saw or power scroll saw is frequently used for cutting disks by arranging an auxiliary table with a pivot pin on which the work can be revolved. When a circular saw is the only machine available, the same thing can be done by rigging a bridge across the table as shown at the left

New Ideas *for* Car Workers

Fig. 1. To get motor's firing order put corks in place of spark plugs and turn the engine over by hand

THERE are several ways to find the firing order of the cylinders of an automobile engine when this information is not marked on the motor. One is to watch the motion of the valves while an assistant slowly cranks the motor. A simple and quick way is to remove the spark plugs and put corks in their places. Turn the motor over slowly by hand and the corks will pop out of the spark plug holes one by one in the firing order.

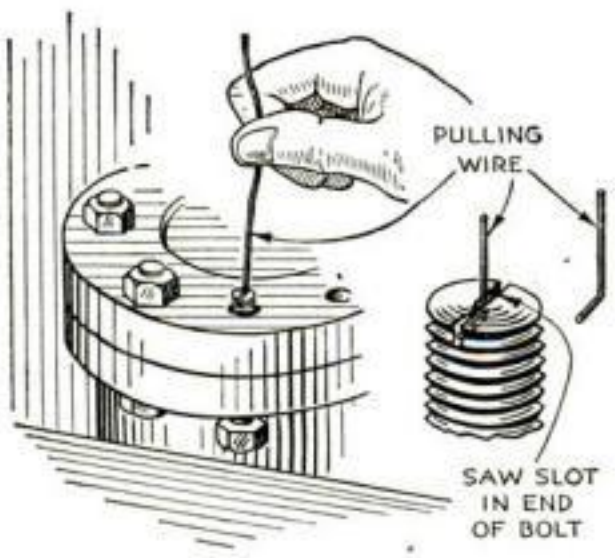


Fig. 2. To pull bolts into cramped quarters, set wire in slot in bolt and thread through hole

Pull Bolts into Place

A WIRE can be used to pull bolts into cramped quarters if you follow these directions: Make a slot in the end of the bolt with a hack saw slightly deeper than the diameter of the wire you intend to use. Place the end of the wire in the slot and peen the edges over the wire. Bend the wire at right angles so that it is parallel with the axis of the bolt. Thread the wire through the hole, pull the bolt after it, and slip the nut over the wire so that it can be started on the threads. Wire can then be pulled free and a screw driver used to hold the bolt while the nut is being tightened. In some cases the wire must be inserted before attaching bolt.

Fig. 3. Short circuits prevented with rubber under packing nuts

Short Circuits

ASSUMING that the ignition cables are in good condition, the points where water can cause a short circuit are around the ends of the wires at the distributor cap and across the spark plug insulators. Figure 3 shows a way to make the distributor cap ends of the high tension wires absolutely waterproof. Thread the ends of the sockets on the cap and fit brass packing nuts with rubber packing rings as shown. For a complete job, the terminal of the ignition coil should be treated in the same manner and all the spark plugs should be equipped with waterproof jackets such as are sold for installation in marine engines.

WIN A $10 PRIZE

Each month we award $10 for the best idea sent in for motorists. This month's prize goes to M. L. Abele, Honolulu, Hawaii (Fig. 4). Contributions are requested from auto mechanics, and if printed will be paid for at usual rates.

Fig. 4. A fabric strap across the back seat with a loop around baby keeps little traveler safe

Traveling with Baby

TRAVELING with a baby aged six months to two years is a nerve-wracking and perhaps dangerous job. So much attention is paid to the baby to see that he doesn't get into trouble that the driving may be neglected at a critical moment.

Figure 4 shows how to make the baby safe and yet give him sufficient freedom to keep him from fretting. Fit a strong fabric strap across the back seat as shown and loop under this a shorter piece of webbing that can be attached to a suitable harness made to fit the child. Any secure form of fastening can be used to adjust the length of the loop to give the child all the freedom possible without subjecting him to the danger of falling.

Repairing a Muffler

WHEN the rear head of a muffler blows out, the common practice is to replace the whole muffler. However, it is possible to repair a break even as serious as this at little expense. Figure 5 shows the method. First cut a strip of sheet metal several inches wide and long enough to fit around the muffler with ends

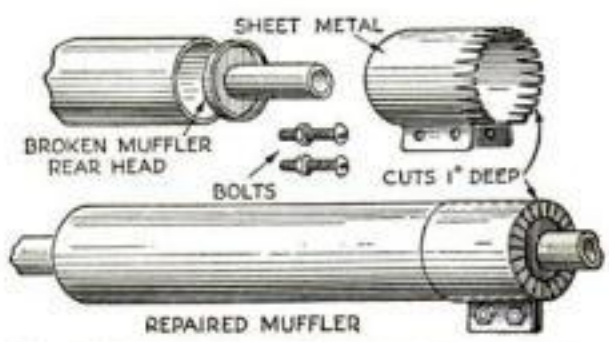


Fig. 5. A blown-out muffler rear head can be repaired with sheet metal cut and fitted as shown

bent at right angles as indicated. With the tin shears cut a number of narrow V-shaped slots, about one inch deep, along one edge. Fit over the end of the muffler with these edges protruding and bend over as shown. A couple of bolts tightened in holes drilled in the bent-up ends will draw the band tightly around the muffler and hold it together.

A Handy Jack

A SIMPLE, quick-acting jack that has many uses around the garage is shown in Fig. 6. The uprights and lever can be made of wooden two-by-fours with one-half- or five-eighths-inch stove bolts for

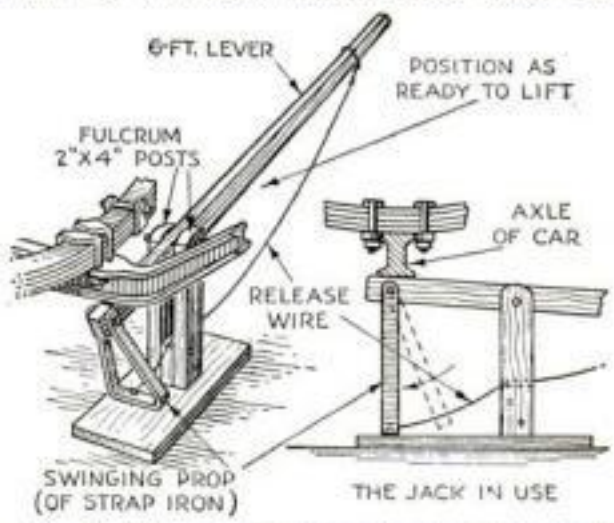


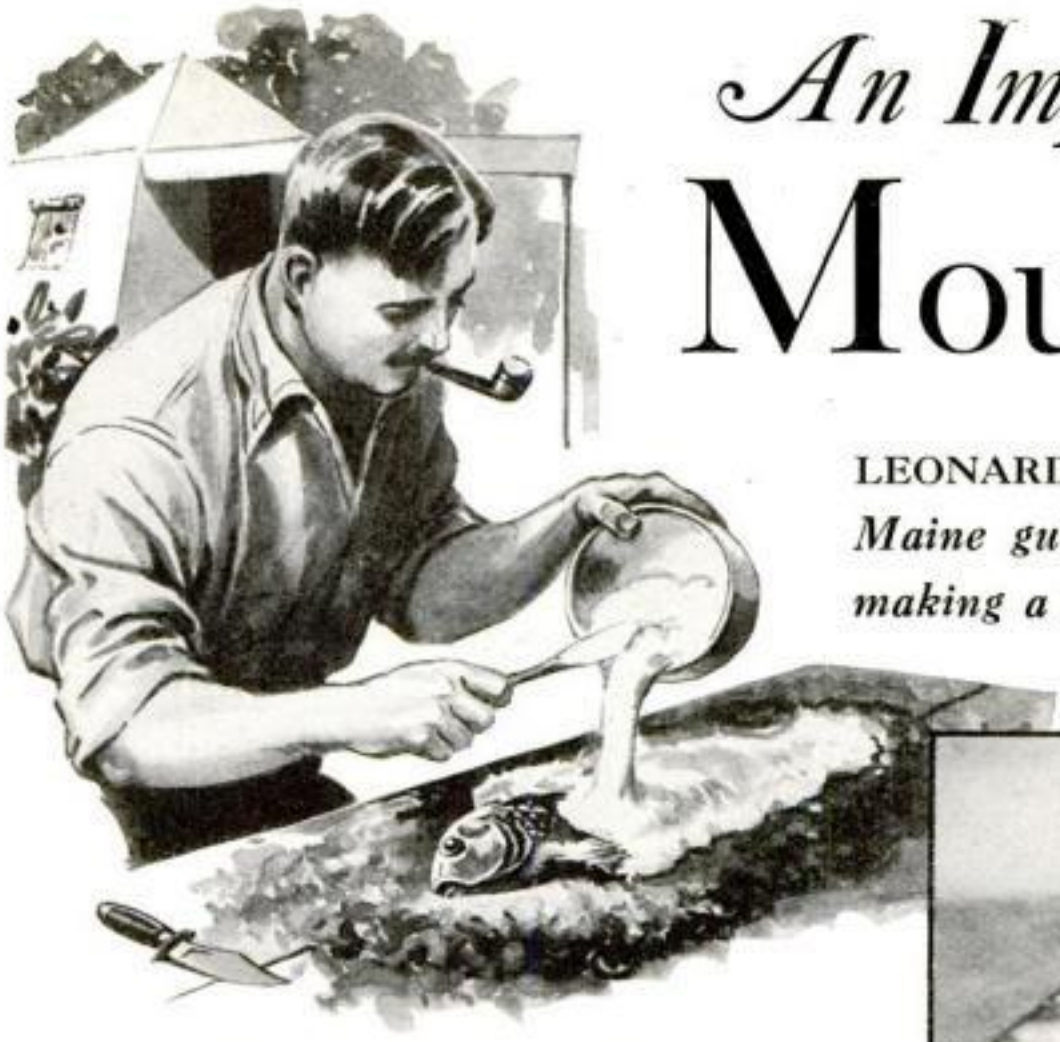
Fig. 6. A homemade jack with strap iron foot and wooden lever finds many uses in garage

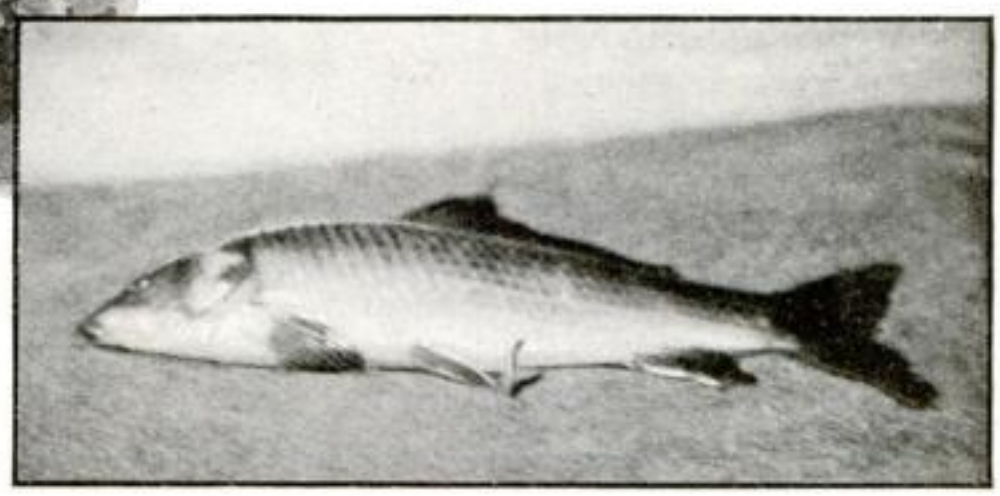
hinge pins. When the release wire is pulled back, the strap iron foot swings back and up so that the business end of the lever can be placed under the axle. When the wire is released and the other end of the lever depressed, the axle is raised and the foot automatically swings into place to keep the load in the elevated position. Pressure on the lever, while the release wire is being pulled, allows the axle to be lowered.

August 1932

An Improved Way to
Mount a Fish

LEONARD F. MERRILL, *expert fisherman and Maine guide, overcomes the usual difficulties by making a plaster cast before the catch is skinned*





1 The best side of the fish is placed uppermost on a flat board or table top, and clean dry sand is piled around until only the upper half of the fish is showing. Plaster of Paris mixed with water to the consistency of cream is then poured over the fish until ¾ in. thick

THE hardest part of mounting that "big one" of your fishing trip is to catch him. The rest of the work is quite easy if you know just how the expert goes about it.

In addition to the regulation rod, line, hook, and lure, you must add one or two special items to your tackle box—a can holding about 3 lb. of plaster of Paris, about ½ lb. of table salt, a small pair of scissors, and 2 yd. of white cloth. If the entire mounting is to be done in camp (which is advisable if at all possible), the salt may be left out and a little powdered arsenic added to the kit in its place.

As soon as the fish is landed, insert a penknife through the gills and sever the spinal cord. Moisten the cloth and wrap the fish in it, and do not allow the cloth to dry out completely at any time. Handled carefully, the fish can be carried all day without hurting the skin. Never wrap a fish to be mounted in grass, leaves, ferns, or moss.

Return to camp a little early that night, as you have quite a chore to do before you can crawl into your bunk. First, the fish must have his picture taken in plaster of Paris; second, he must be skinned; third, the skin must be placed in a preservative.

Making the Cast. Select the best side of the fish and place it uppermost on a flat board or table top. Pile clean dry sand around the fish until only the upper half is showing. Mix plaster of Paris with water to the thickness of heavy cream and pour it over the fish to about ¾ in. thickness. After the plaster has set, remove the fish and wipe with a dampened cloth, and set the cast aside to harden.

Skinning. The two paramount rules in skinning are, *do not hurry*, and *keep all parts of the skin damp.* To start, place dampened pieces of cloth on all fins except the lower front fin on the under or poorer side. Place the fish on a board with the poorer side uppermost. Lift the gill covering and with the scissors cut the arch of bone between this and the body. Make a clean, but not deep, incision with a sharp knife up the side to the tail.

Separate the skin from the flesh by holding one edge of the skin and using a scraping motion with the knife. Use extreme care when the fins are reached, or the fin will be left attached to the body instead of to the skin. Cut the fin bones with the scissors, leaving some flesh to be scraped off and bones to be cut after the body has been removed.

As the work progresses the skin and fins should be dampened from time to time.

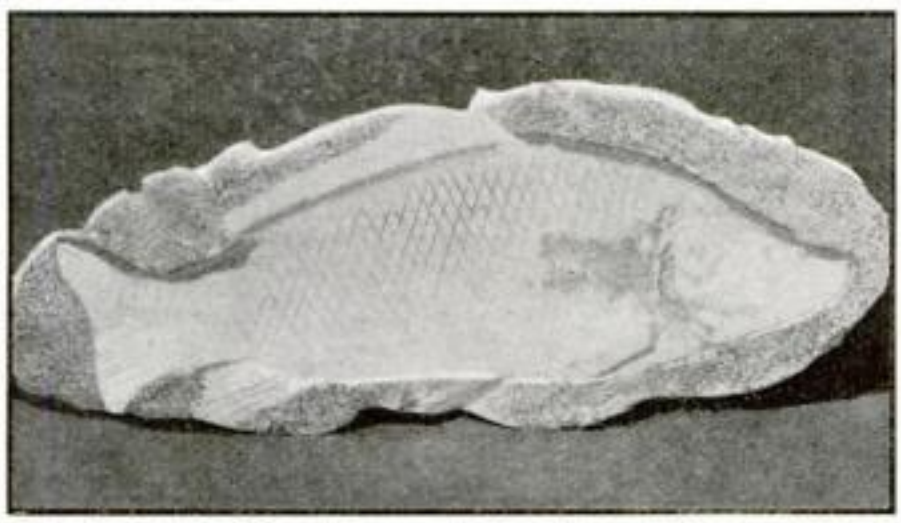
Free the upper part of the skin to a point behind all fins; then work off the skin all the way around so that the scissors can cut the body off at the base of the tail. From this point on the skinning is done toward the head. Lift the body as necessary but do not turn the fish over. When the head is reached, the body is cut off as close to it as is possible. Remove all flesh that may remain on the skin, and trim the fin bones as close to the skin as possible. Be very careful not to scrape off the inner silvery skin, as this is what gives the scales their sheen.

To Clean the Head. Remove the gills by cutting away their attachments at top and bottom. Remove the remaining vertebrae and flesh by cutting and scraping, and also remove the brain. Remove the eye and dig out the flesh on the side of the face just behind the eye. The flesh of the cheek may be dug out if the protecting bone is first cut away. All flesh must be removed or the skin will spoil.

If the job is to be finished at home, the only thing left to do at this time is to place the skin in a brine solution, made by dissolving as much salt in water as is possible without heating the water. The skin is placed in the brine so that the fins are not bent out of shape and left till the final mounting is to take place, when it is removed and washed in clean cool water.

Poisoning. The skin must be poisoned to prevent its being destroyed after it has been mounted. When thoroughly cleaned, a little powdered arsenic is put on the inside and well rubbed in. Wrap the skin in a damp cloth and let stand overnight.

Before removing it from the



2 After the plaster has been poured over the best side of the fish and has set firmly, the fish is removed and wiped with a dampened cloth. The cast itself, which will show every marking even to the scales, should then be put aside to harden

cloth, make a setting board to put inside the fish when stuffed. This board is to tack the back edges of the skin to and also to hold the screws for attaching the specimen to the mounting board. The setting board should be the same general shape but about 1 in. smaller all around than the actual fish. Determine the size and shape from the cast. Do not make it more than ¾ in. thick except in the case of a very large fish. Bevel the edge all around, and in the final mounting put the larger surface inside or toward the front.

Mounting. Dampen the cast with clean water, remove the skin from the cloth and fit it into the cast. Be sure all parts fit perfectly; then fold back the overlapping edges and pour a thin coating of plaster over the half of the skin in the cast. With the fingers, spread and press the plaster well into all parts, and do not overlook the head. Continue until the half skin is full, then set the board in place. Draw the edges of the skin over the board and press plaster between the edges of the board and the skin until the fish rounds away in a natural manner. Tack the edges of the skin to the board with small carpet tacks. Remove the whole from the cast, wipe with a damp cloth, and set aside to harden.

The board for the final mounting may be shaped to suit individual taste, but should be of hardwood and at least 3 in. larger all around than the fish. After the board is shaped, drill two holes for screws spaced so they will enter the board set in the plaster. Near the top of the main board bore two holes halfway through from the back. These holes, which should be large enough to receive the heads of two screws, will serve to hang the mounting on the wall.

When the board has been stained and varnished, the fish may be screwed into place.

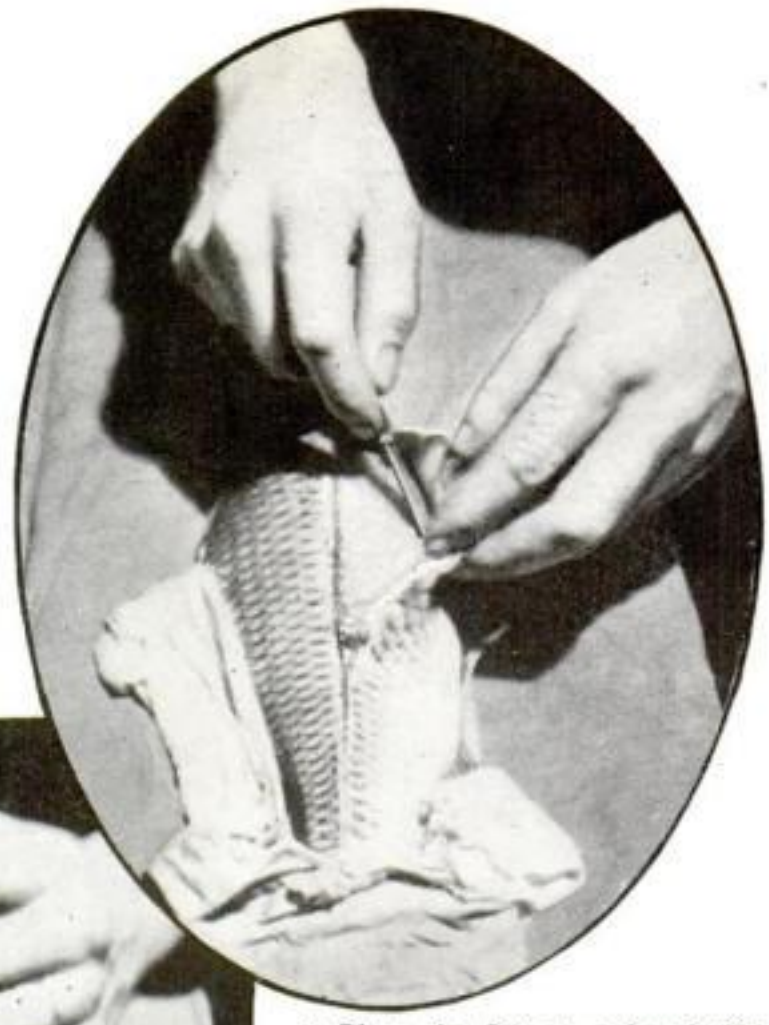
With a knife dig out the plaster in the eye socket and use a little fresh plaster to set a glass eye in place. The eye can be obtained from a taxidermist or concern dealing in taxidermist's supplies.

Painting. Transparent oil colors, such as are used to tint photographs, are used to paint the fish. Look up a good color plate of the kind of fish you have, then paint it as nearly like the plate as you can. Remember that a little paint goes a long way on a fish, especially the bright colors. When the paint is dry, the whole fish is given a thin coat of clear spar varnish.

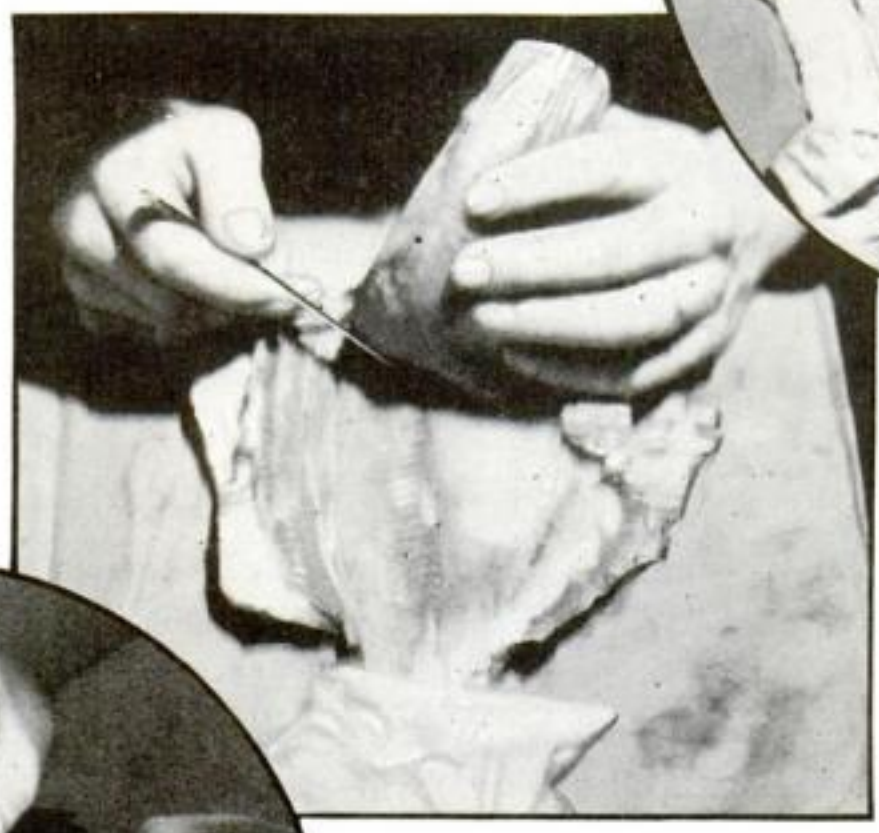
Carding the Fins. One improvement over the method just described is to "card" the fins to keep them from curling while they are drying. Just before setting the mounted fish aside to harden, place a piece of thin cardboard on each side of each fin and use pins to hold the pieces together. Be sure the pins pass through the cardboard only and not the fins.

To make the mounted fish a complete story in itself, some fishermen inscribe the length, girth, and weight of the fish, the date, and the place where the catch was made on a copper or brass plate and mount this in the center directly under the fish. Of course, if desired, this information can be typed or lettered on a label pasted on the back of the mounting board.

If an artificial lure or bait was used to catch the fish, the mounting can be made even more realistic by hooking the lure into the fish's open mouth and running a short length of line to the upper edge of the mounting board.

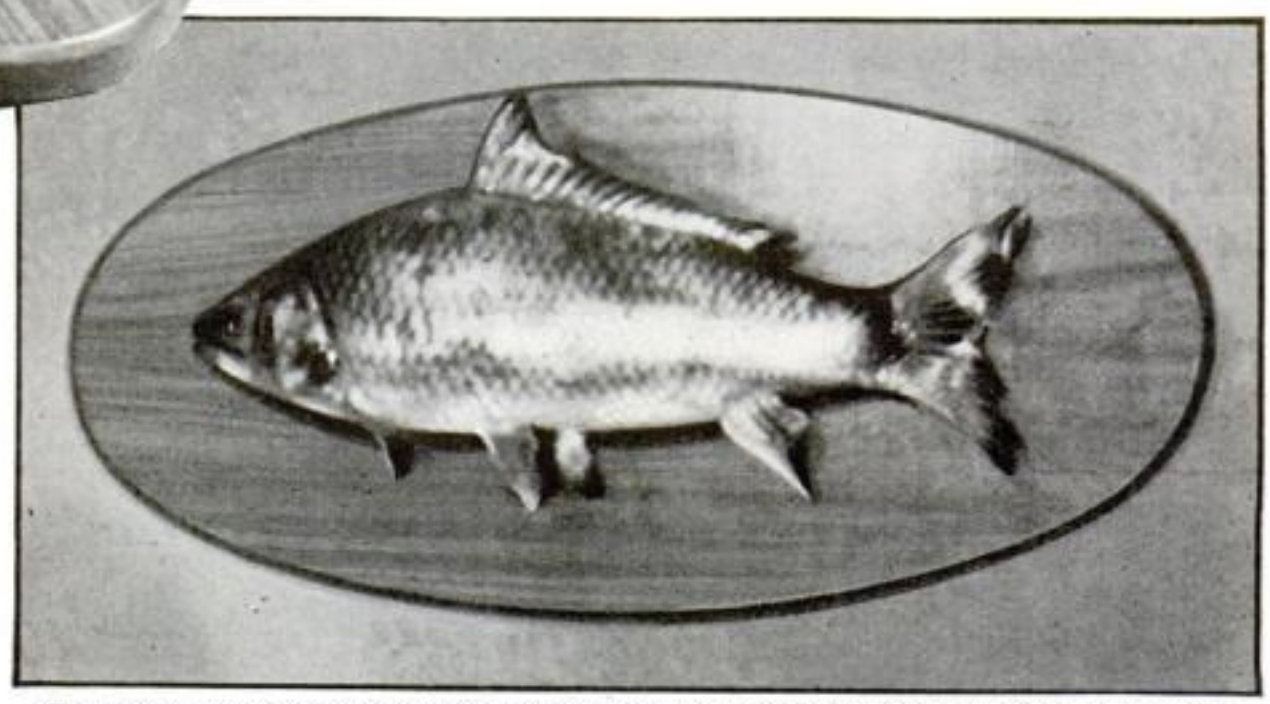


3 Place the fish on a board with the poorer side uppermost and wrap the fins in damp cloths. Make a lengthwise incision, clean but not deep, and separate the skin from the flesh gently with a scraping motion



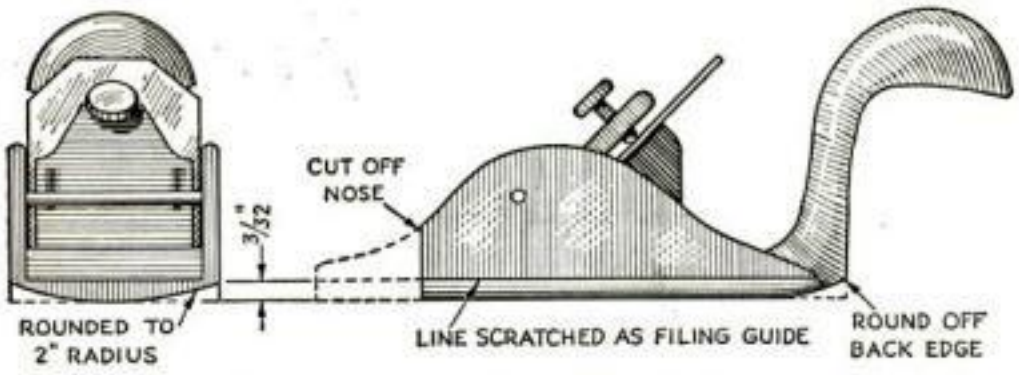
4 Free the skin of the upper side to a point behind all fins; then cut the body off at the base of the tail. Work back and remove the body at the head

5 The skin is placed in the original mold and plaster is poured inside. A "setting" board is inserted, the edges of the skin are tacked to it, and the fish is fastened to its mount and painted with oil colors

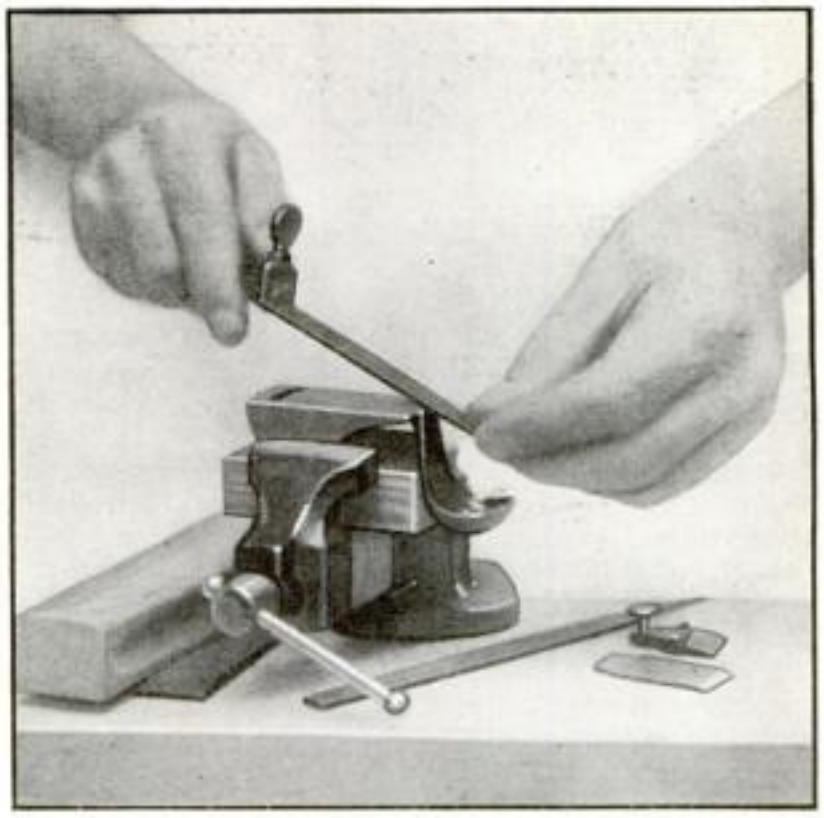


The hardwood mounting board may be of any shape desired, but have it at least 3 in. larger all around than the fish. Stain and varnish the wood before attaching the fish with screws

Block Plane Converted into Special Model Making Tool



Front and side views of the special model maker's plane. It is made from an inexpensive block plane about 3½ in. long with a 1-in. cutter



After the end has been cut off, the bottom of the plane is rounded either with a file or by grinding, as preferred

HANDY tool though it is, a round bottom plane is seldom found in the kit of the amateur model maker, woodworker, or hobbyist. Chisels and gouges are used for carving the sheer lines and bow curves of clipper and fast schooner models and for curved work of similar delicacy, but the proper tool is a small convex plane that can be used with one hand and will take a fine shaving from a concave outline or contour. There are special model maker's or pattern maker's planes of this type, but the demand for them is so small that they are relatively expensive. However, such a plane can be made for about fifty cents from an iron block plane of the kind commercially designated as the "No. 100" pattern. This is equipped with a small cast-iron knob or handle at the back which fits snugly in the palm of the hand and aids in guiding and pushing the plane over the work.

As purchased, the plane has a flat sole or bottom, which can either be filed or ground to shape. If you intend to use the file, first remove the cutter and secure the plane bottom up in the vise; then use a hack saw to cut off the front end of the plane to within ¼ in. of the front edge of the opening through which the cutter projects. With a sharp point or scriber, scratch a line along both sides of the plane about 3/32 in. or a scant ⅛ in. from the bottom edge. With an 8- or 10-in. medium cut mill file, start filing along this edge, making a gradually rounding surface to the center line of the plane bottom. When you have practically finished this curve, turn the plane end for end in the vise and repeat the filing operation on the other side, after which you may take out the file marks and polish the surface by using medium fine emery cloth. The cutter should then be ground to match the curve of the plane bottom.

A shorter and more desirable method, if you have a 6-in. or larger grinding wheel, is to adjust the cutter as if to take a very fine shaving and fasten it securely, and grind the bottom and cutter in one operation. Before doing this, cut off the nose of the plane so that there is only enough material ahead of the cutter slot to guide the blade. Hold the plane as if about to plane with it against the side of the grinding wheel and gently rock it from side to side, occasionally inspecting the work to make sure that the grinding is gradually and evenly reducing the bottom to a true arc of a circle. After this has been done, the cutter should be removed and sharpened.

With either method it is desirable to round the back edge of the plane under the handle slightly so that the tool can follow curves of small radius without any danger of denting or otherwise marring the wood.—J. P. FITCH.

TABLE LAMP CONSTRUCTED FROM SPOOLS

You need not have a lathe to make this attractive, modern looking table lamp. The so-called "spool" effect in this case is obtained by actually using spools. Cut-off sections of the spools are assembled by slipping them over brass tubing

A DECORATIVE table lamp having a modern "turned" effect can easily be made from large wooden spools, obtainable at almost any tailor's shop. In the center of the wooden base, which should be about 7/16 in. thick and 4 in. in diameter, drill a ⅜-in. hole and insert a piece of brass tubing for aligning the spools. Now cut off and discard one end of the largest spool, apply a thin film of glue on the cut end, slip the spool over the tube, and press it in contact with the base. Repeat this operation for the second spool, slightly smaller in size, gluing one on top of the other. Add a third spool and if the lamp is not high enough, continue until the proportions are satisfactory. Glue three small feet, made from discarded sections of the spools, to the base. After the glue has dried, trim off the surplus and give both pillar and base a coat of stain or lacquer.

The upper end of the brass tube should be threaded to take an ordinary lamp socket. The electric wires run down through the tubing to the base of the lamp and thence to the outlet. A round parchment shade, homemade or purchased, is clipped over the electric bulb and adds the finishing touch to this unique and inexpensive lamp.—RALPH SPRUNGMAN.

TRANSPARENT COVERING NOW USED ON KITES

THIN wrapping material of the cellophane type can be used for covering kites. It can be obtained in various colors, but if you use the plain transparent kind the kite will go out of sight in no time at all —and that is more of a novelty than using color. Apply the cellophane like ordinary tissue paper, allowing about ½-in. overlap on the edges for pasting. Ordinary flour and water paste will hold, or you can use cellulose household cement. There is only one thing to avoid—sharp corners. It is best to secure a bit of adhesive tape over the stick ends before covering to be absolutely sure of smooth surfaces. If the cellophane is pierced for a belly-band, reënforce the hole with a small circle of tough paper to avoid splitting the covering. This stunt will make a tough, durable covering that is different from all the rest.—INMAN COOKE.

Hints on Saving Time and Expense in

MILLING MACHINE WORK

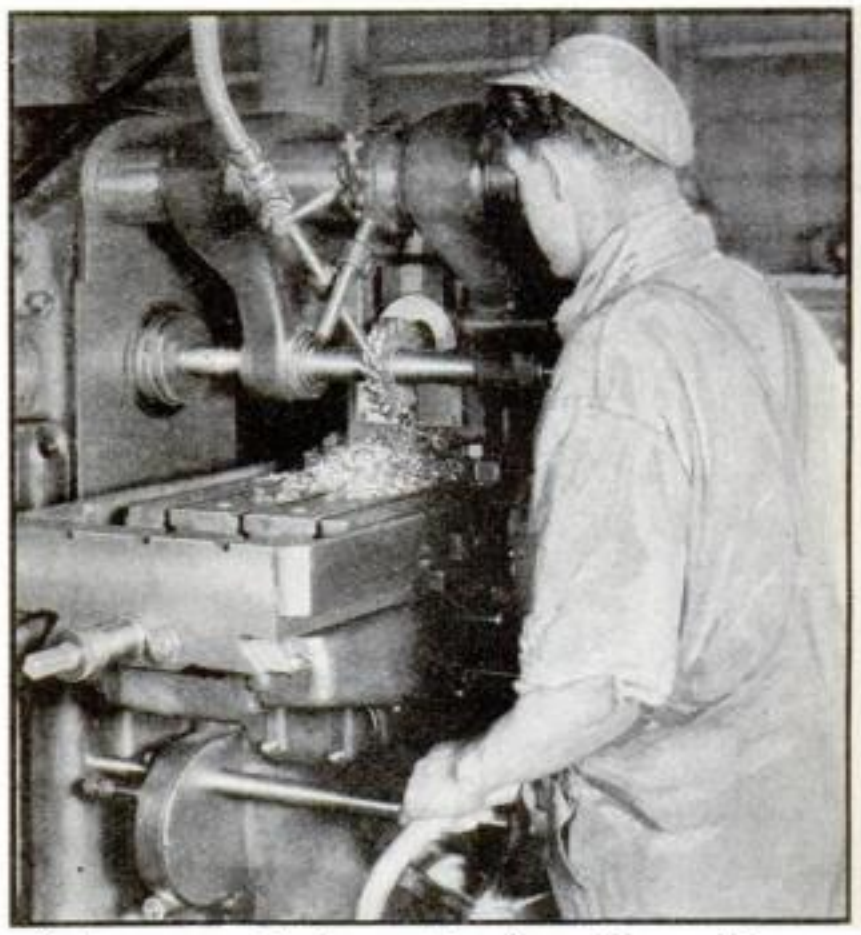
By Hector J. Chamberland

AN ALERT mechanic can do much to keep down the cost of milling operations in a small machine shop, no matter how limited the equipment may be. A number of hints on how to make old milling cutters do the work of new were given last month (P. S. M., July '32, p. 83), and other timesaving ideas are illustrated in the drawings below. Each machinist, of course, will have to adapt the ideas to his own specific problems as they arise.

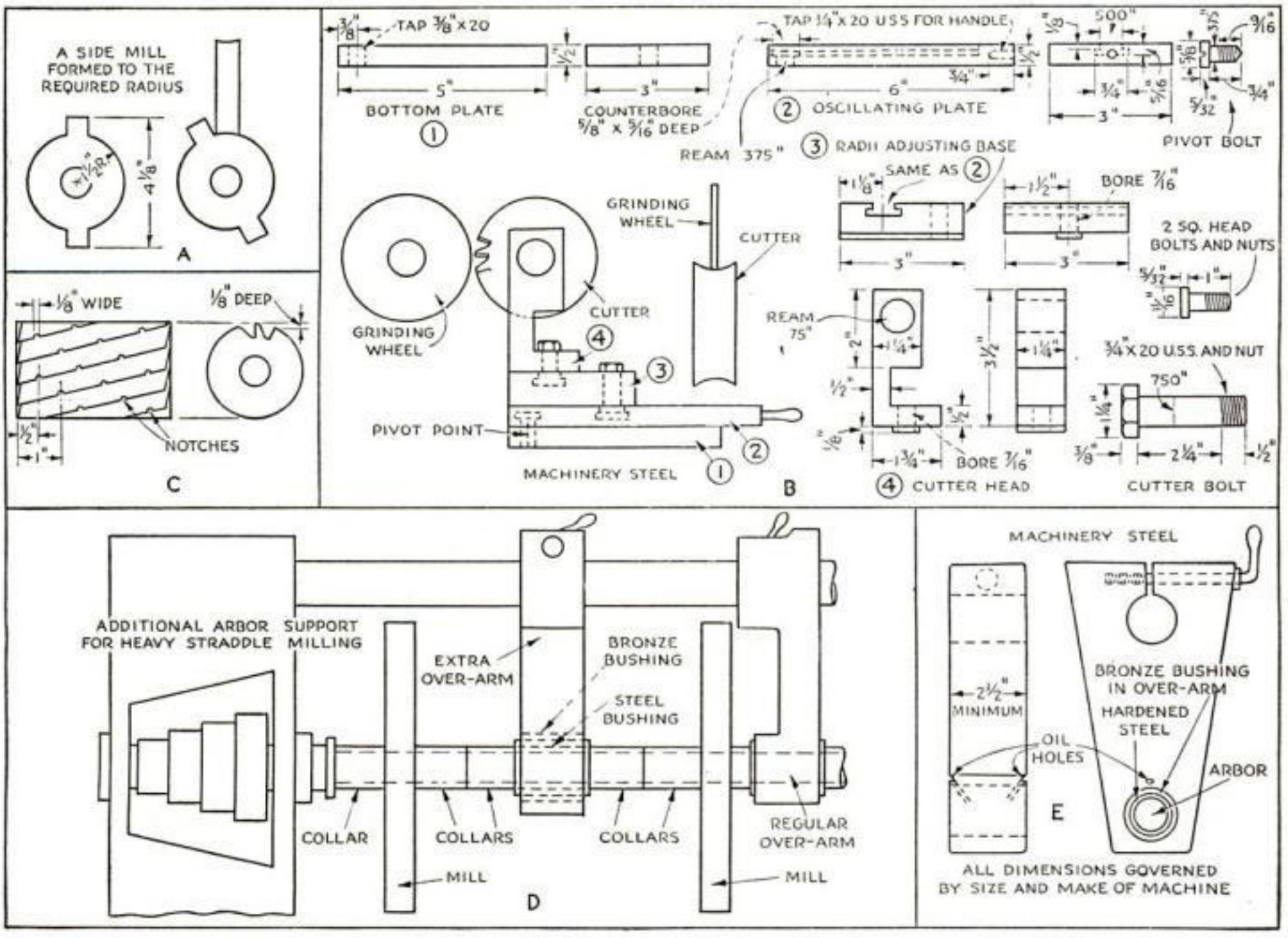
The job shown at *A* is a familiar one in every shop. It is usually done with an end mill, whether there are several cast pieces to be machined or one part has to be made from ordinary stock. The regular method requires the use of two different cutters and doing some filing, but the work may be done much faster by forming the required radius on a side mill. One with a 1-in. face is advisable in this case.

The fixture illustrated at *B* is well adapted for use in a small shop for grinding a cutter for this kind of milling job. In many cases, furthermore, it will do away with the necessity of making forming tools. It can be machined for about twenty-five dollars, and the cost of making two average forming tools would exceed this amount. Part No. 4 may be adjusted on part No. 3 to bring the cutter and wheel centers in line. The concave or convex radii are obtained by adjusting part No. 3 on No. 2 in relation to the pivot point. The writer has used such a device for several years and it has repaid its cost many times.

Regardless of the condition of the milling machine, a long end mill will always cut



To become expert in the operation of a milling machine requires experience, attentiveness, and quickness in control



A fixture for grinding a radius on a side milling cutter, a supplementary over-arm for heavy straddle milling jobs, and other suggestions

heavier at the top than the bottom; this is due to a slight springing action that is unavoidable. This trouble may be corrected by noting the amount of error and relieving the mill on a taper.

A trick that goes a long way to insure a smooth and clean cut is suggested at *C*. Few average shops purchase cutters in this style because they cost more, but they are worth the extra charge. The purpose of this design is to break the chips, thus allowing a faster cut; besides, if a tooth accidentally starts to strip, the break is limited between notches. All cutters having a face of more than 3 in. should be given this improvement. The work can be done in fifteen minutes as follows: Give the teeth a coat of Prussian blue and mark the locations with a pencil and scale; then, holding the cutter in the hands, cut reliefs as shown. An elastic wheel is the best to use in this case.

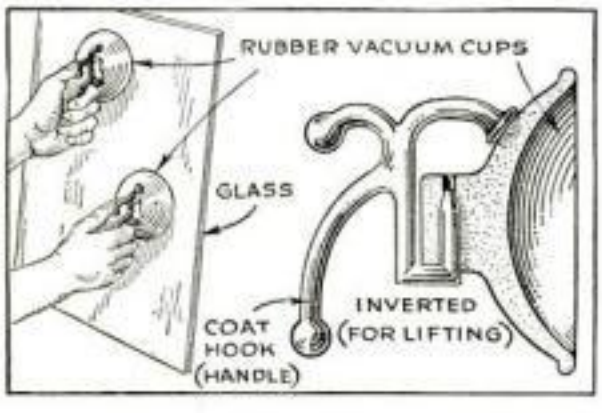
Probably the most severe test given a milling machine is when a set of heavy straddle mills is used. The operator should exercise good judgment and select an arbor large enough for the work. A study of the diagram marked *D* will show the advantages of using some reënforcement at a point where it is needed the most. It is obvious that when 12-in. mills are mounted some distance apart, the extra attachment is of great value in insuring accuracy and extending the life of the tools between grinds. To break up the job for grinding the cutters always involves an expensive delay because a new set-up becomes necessary. The cut is never the same once cutters have been disturbed.

The supplementary over-arm is shown in detail at *E*. While the design is simple, this device is a worth while addition to any milling machine not already equipped in this manner.

From the suggestions offered in this article and in the one published last month, it is clear that much can be accomplished with very little in the way of milling equipment. A thorough check-up of the tool crib will usually bring to light a certain amount of equipment that can be used in some form, shape, or manner. And the more methods a mechanic can devise to help his company along, the better it is for him.

This is the second and concluding article by Mr. Chamberland on milling operations in the small machine shop.

SHEET GLASS HANDLED WITH VACUUM CUPS

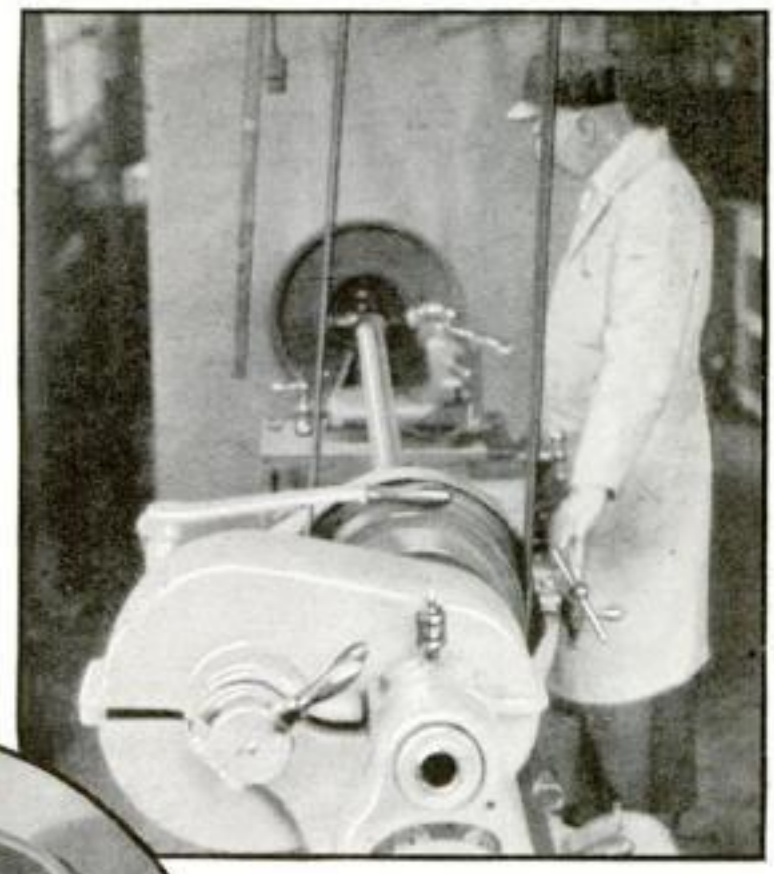


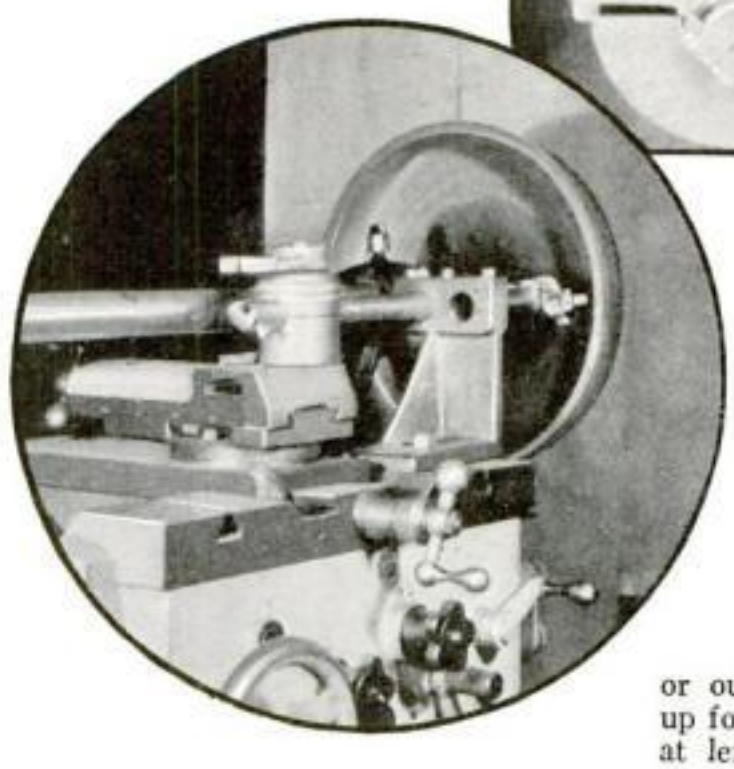
Two coat and hat hooks of the type having vacuum-cup attachments make convenient handles for lifting sheet glass. The vacuum cups should be dampened—but only slightly—before they are pressed against the glass.—Martin Winterton.

TURNING BRAKE DRUMS ON SMALL LATHE

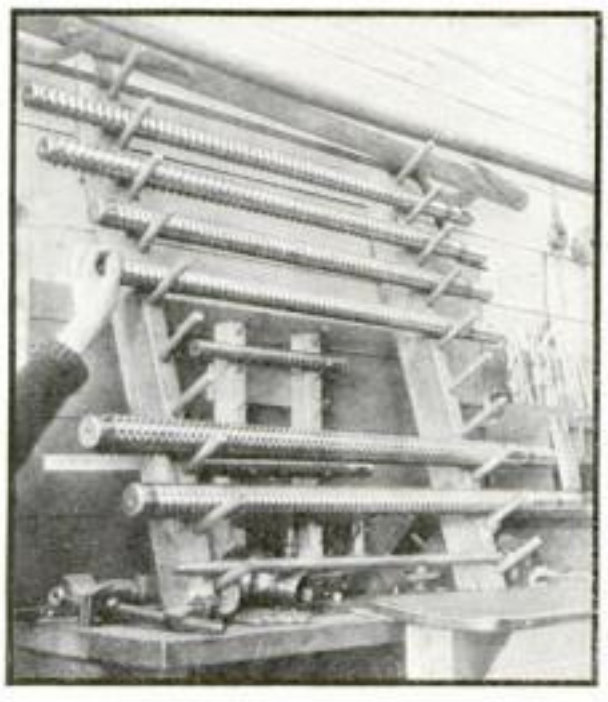
A few changes in any substantial screw cutting lathe make it possible to turn down brake drums regardless of their diameter. They are swung at the end of the lathe. To do this, a shafting bracket is mounted in place of the tailstock and lined up with the live center of the headstock.

A line shaft—that shown is 2½ in. in diameter—is then mounted in the lathe, one end being carried in the shaft bracket bearing and the other being chucked at the headstock end. This shaft is turned down with a steep cone at the "outboard" end. Another short piece, which is also cone shaped at one end, slides over the turned-down end of the shaft and is pulled up tight by a nut threaded onto the end of the line shaft. The brake drum to be turned is left mounted on its hub, which is gripped between these two facing cones. A substantial extension of the tool post carries the cutting tool for refacing either the inner or outer surface of the drum. The set-up for refacing the inner surface is shown at left.—C. Edward Packer.





Brake drum mounted at tail end of a lathe by means of a shaft and bracket bearing. *Left*: How tool is held



RACK HOLDS ASSORTMENT OF HEAVY BROACHES

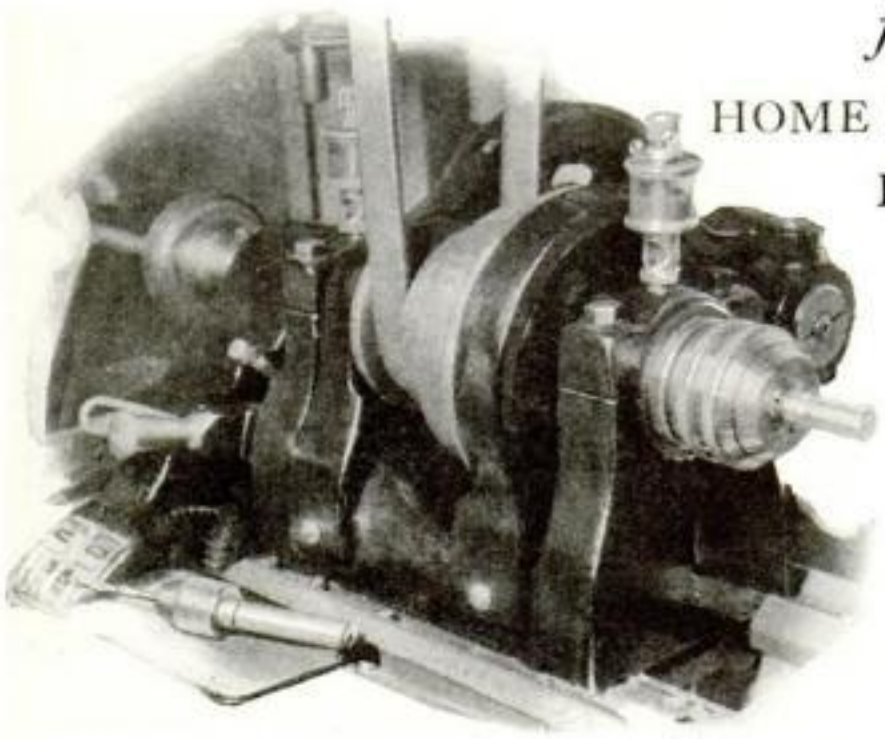
The rack illustrated above is useful for storing large broaches and similar tools in the tool crib of a machine shop. Small steel pins or heavy spikes are driven into one edge of each of the wooden members, which are then set at an angle against the wall as shown. In most cases "two by fours" can be used for the supports. To avoid damage to the broaches or other sharp edged tools, the spikes are sheathed in short sections of rubber tubing.—C. J.

HANDY ROD HOLDER FOR A PORTABLE WELDER

A welding rod holder for use on a portable welding outfit which saves considerable time can be made from scrap materials. The holder, which is illustrated below, is removable. It consists of an 8-in. length of 3 in. diameter tubing and two other shorter and smaller tubes welded to an 8 in. square base of 1/16 in. thick steel plate. The holder support is another 8-in. square of 1/16-in. stock welded to the frame of the outfit so that it projects inward. Two 1½-in. lengths of ¼-in. rod welded near the outer edge of this plate fit in holes in the base of the holder to keep it in place. A hook welded to the top edge of the largest tube at the rear allows the holder to be hung where desired or conveniently carried to the tool room for replenishing the supply. As shown in the photo, more than one holder can be used on each welding outfit.—Joseph Coyle.

Set of removable holders for welding rods

A DRAW-IN Chucking Attachment *for the* HOME MACHINIST'S LATHE



Attachment for holding a ½-in. collet and a variety of split bushings. Note the small drill chuck for use with the collet

By *Holt Condon*

A DRAW-IN chuck or collet attachment may be bought as extra equipment for a home workshop screw-cutting lathe. The one shown here, however, was made by the writer in the lathe in which it was to be used. The working out of this problem gave not only a valuable tool for the rapid and accurate chucking of small work, but also the satisfaction that attends real craftsmanship.

The 9-in. lathe for which the attachment was made has a spindle bored to ¾ in. and admits nothing larger than ½ in. through the collet type of chuck. As these collets are hardened and ground, they are necessarily expensive, so but one—the largest—was bought. With this ½-in. collet and certain dimensions fixed by the lathe spindle, all necessary requirements were at hand and work was begun.

A piece of Shelby seamless tubing 14 in. long with an inside diameter of 9/16 in. and an outside diameter of ¾ in. was mounted in a steady rest, faced, bored to a depth of 11/16 in., and threaded ⅝ in./26 to take the end of the collet. While set up in this way, the tube was cleaned up and the center section turned down slightly to prevent its cramping in the spindle bore. A thread was chased on the end for fixing the handpiece.

A walnut wood handwheel, bored to fit the flanged handpiece, was attached with three wood screws, and then finish turned in place and polished. A flush locknut locks it to the tube. The fillet to be seen turned on the handpiece at its junction with the tube finds a matching countersink in the outboard end of the lathe spindle, and when engaged, centers the tube in the spindle in which it otherwise fits loosely. The wheel makes a snug handful and offers plenty of grip, yet is smooth enough to be safe as it revolves.

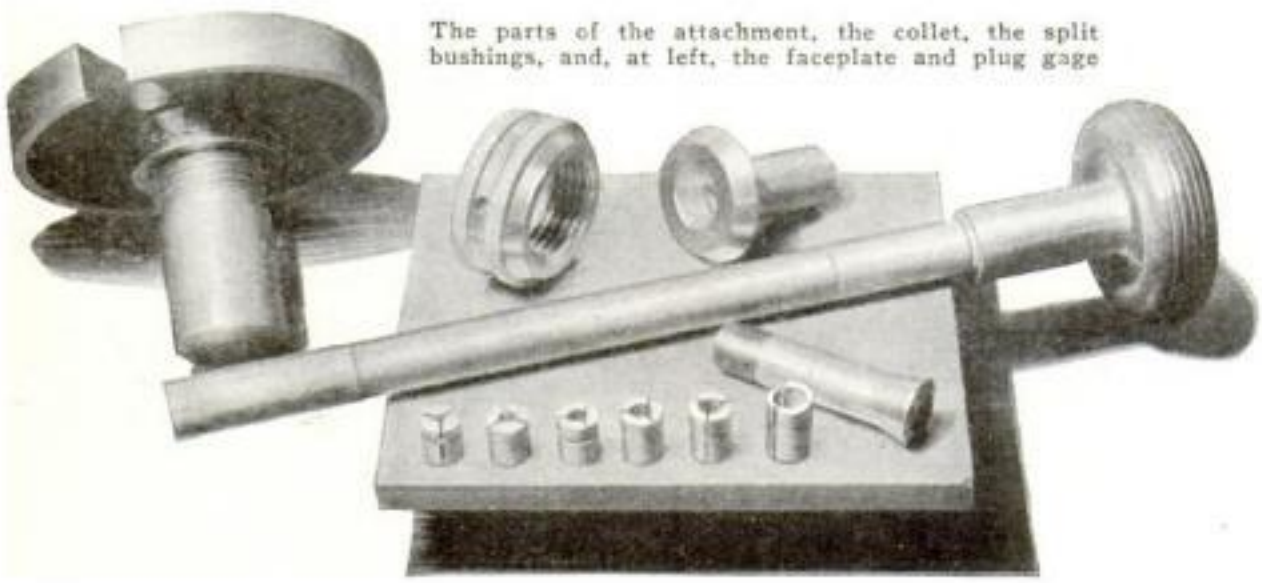
Careful sizing and fitting of the adapter sleeve is essential if the chuck is to run true. This part not only centers and lines up the spring collet, but with its short bored taper restricts the collet when drawn back through the spindle by means of the handwheel and tube. This sleeve was made from a section of cold-rolled shafting. The length of tapered shank back of the flange is 1¼ in.; the flange thickness is 5/16 in. and the diameter 1⅞ in. It is important that the sleeve support the collet at two points only: at the short, steep taper at the mouth, and again at the rear of the bore for a length of ⅝ in. At this point a key is set which drives the collet when in use and prevents its turning with the tube when being tightened on the work. Clearance in the midsection is necessary to accommodate the spring of the slotted collet. Needless to say, at least 1/16 in. should be clear between the flange of this part and the spindle nose when the tapered shank is set in the spindle.

The threaded and knurled collar was made up to offer protection to the threaded spindle, as a grip against which to turn the hand wheel, and as a means of drawing off the adapter sleeve.

Details of the spindle nose were first noted; then a piece of stock 2½ in. in diameter and with extra length was chucked. Facing, boring, and counterboring followed. A ⅛ in. pitch thread duplicating that in the lathe faceplate was sized through the use of a plug gage shown with the faceplate in the photograph. This represented a good deal of extra work, but the plug will be useful later in boring chuck plates and the like. The collar was turned with lands for knurling, knurled, and cut off. The outer face was cleaned up when in place on the spindle nose, and the chamfer made to continue that of the adapter sleeve. Holes were later drilled for a spanner wrench.

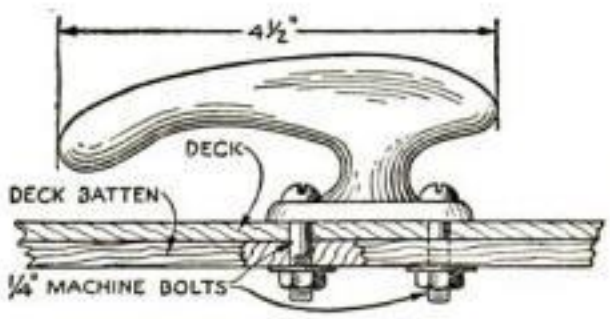
As an inexpensive alternative to preparing a string of collets of graduated size, the little split bushings shown have been made as required. The stock was ½-in. cold-rolled steel though drill rod would have been preferable. The stock was fed through the collet, bored to size, grooved, and cut off. These bushings are split in three segments with a thin blade hack saw and carefully burred with a fine file. To link each set together for convenience in handling, a wire ring is snapped into the groove. Hard drawn brass wire was used for this purpose. This was wound on a mandrel and soldered into a solid mass, and a lathe cut was taken over the coils, reducing the wire section to half round. The solder having been melted off and the mandrel stripped out, a saw cut was made down through the coils to drop them off ready to close on the bushings.

As a useful adjunct to this collet attachment, a small drill chuck with straight ½-in. shank was purchased. This fits in the collet and often obviates changing to a chuck for light drilling jobs.



The parts of the attachment, the collet, the split bushings, and, at left, the faceplate and plug gage

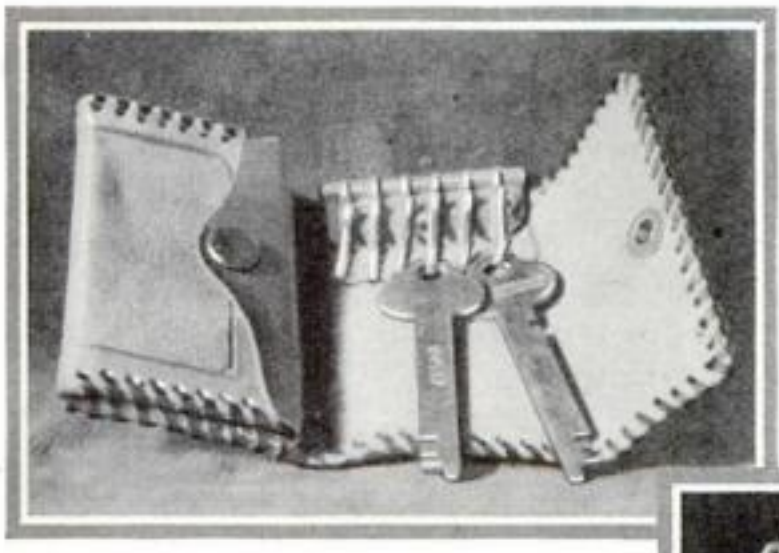
A NEAT MOORING BITT FOR SMALL BOATS



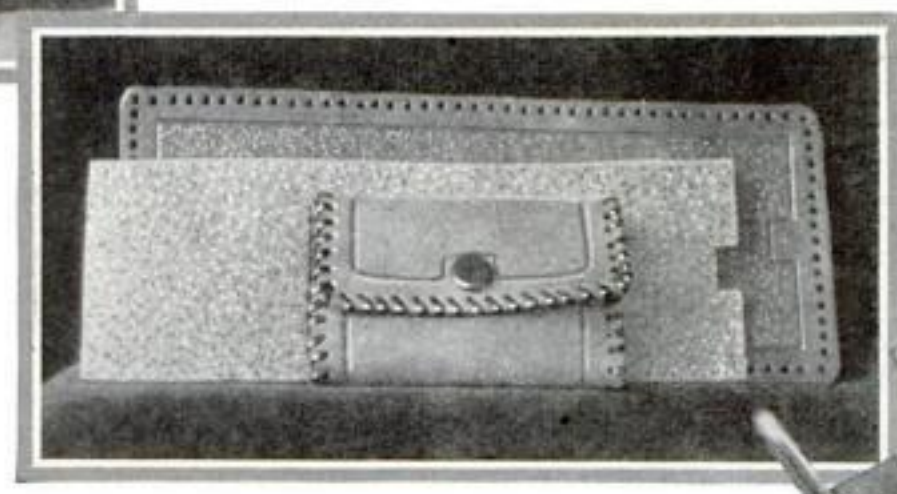
WHEN I had finished building a speed boat from POPULAR SCIENCE MONTHLY Blueprints Nos. 128 and 129, the need for a suitable mooring bitt made itself evident. I tried to find a good-looking one at the marine hardware store, but none suited me. Then I happened to notice the streamlined inside handle of an automobile door. I got one like that shown and dropped a bit of solder in the base to prevent the handle part from turning. Then I drilled two holes for ¼-in. machine bolts in the ends of the base, and bored corresponding holes through the deck and deck batten, placing them about 5 in. aft the bow and in the middle of the deck.—JOHN G. MCKEAN.

Using Sandpaper to Emboss Leather

F. Clarke Hughes suggests a simple but most unusual way to decorate a combination case for keys and license



Besides containing half a dozen hooks for keys, the case, compact as it is, has a pocket for license or identification cards



At left: The cover as it appears when tooled, embossed, and punched; also the coarse sandpaper with which the embossing is done, and the completed case. *Below:* The necessary metal parts

THIS neat looking, handmade leather key case differs from ordinary ones in that it has a special compartment for automobile and driver's licenses or an identification card in addition to hooks for attaching six keys.

The stock for the outside cover should be a piece of tooling calf or any other medium weight leather of sufficiently good quality to be tooled or embossed. This piece, which should be 3 by 9¼ in., is marked No. 1 in the accompanying drawings.

A simple tooled border line with an embossed center space is an appropriate type of ornamentation for this bit of leather craft. Dampen the leather thoroughly and tool the lines with a dull lead pencil about ⅜ in. from the edge of the cover. Then deepen them with a blunt awl made from a discarded nut pick or any other round metal point similar in form to the lead pencil point.

To emboss the stippled panel within the tooled lines, a piece of very coarse (No. 2 or 3) sandpaper may be used. Cut it to fit exactly the space to be stippled. Place a wood block on the bench and lay the dampened leather on it face up. Then place the sandpaper die face down on the leather and lay another block on top of it. Taking care the parts do not shift, squeeze them together in a vise or by using clamps or hand screws.

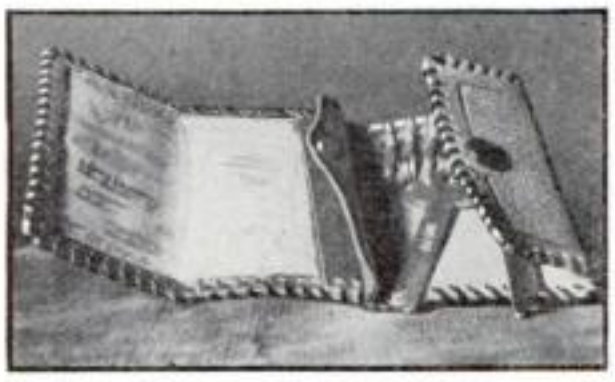
The parts marked No. 2 and 3 may be made from kid or other thin stock. They are so small and narrow that material cut from a pair of discarded slippers or other leather articles might be used. These parts, which serve to bind the edges of the celluloid, should be lightly glued in place before the holes are punched for the lacing. Two pieces of celluloid (marked No. 4) are required, one 2 by 2⅞ in., the other 2¼ by 2⅞ in.

The metal parts may be taken from an old key case, or a cheap new one may be purchased at a five-and-ten-cent store and fastened in the handmade leather case with ordinary tubular paper rivets. Holes should be punched in the leather cover to match the ones in the metal plate holding the hooks. If the paper rivets are put through the leather and the metal with their heads on the outside as shown in one of the accompanying sketches, it is a simple matter to spread the sharp ends with the large conical end of a steel punch and flatten them with a hammer.

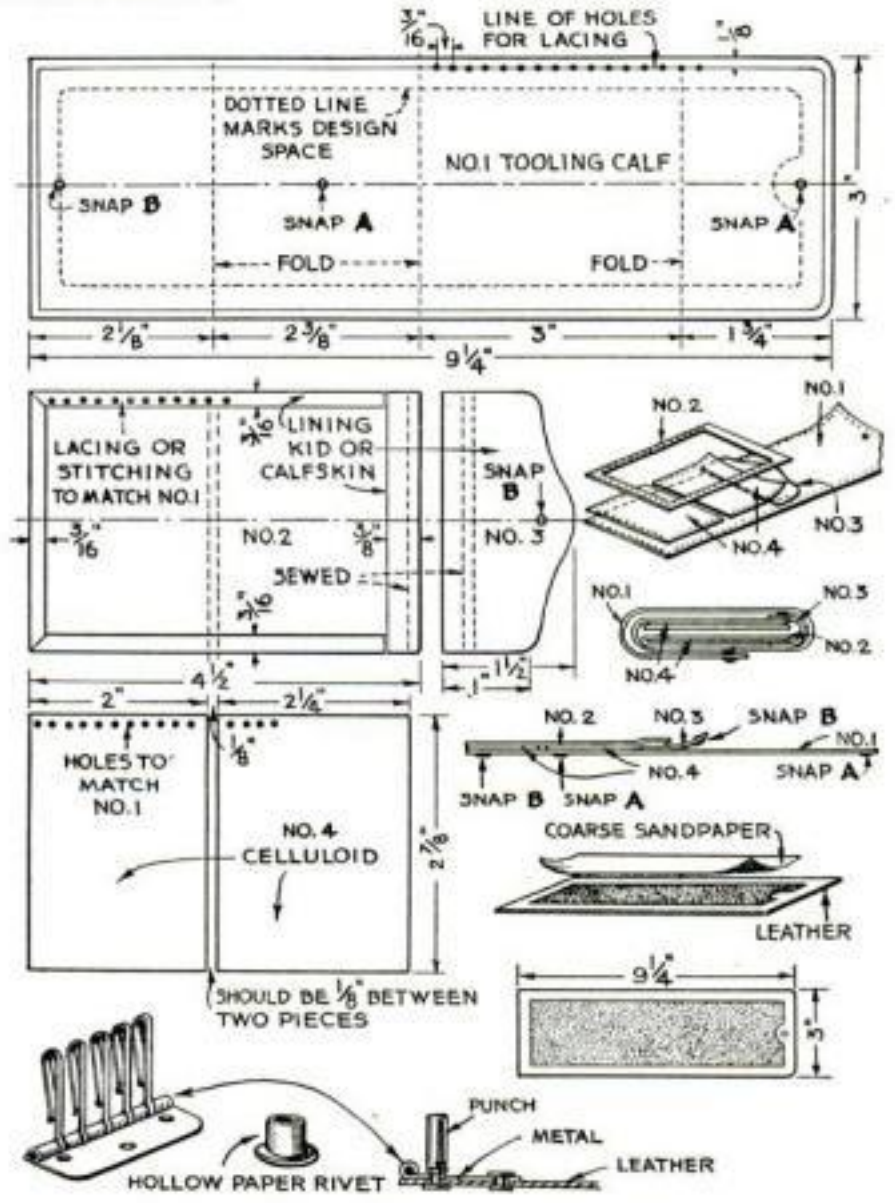
The two snaps should be inserted by a shoemaker or leather worker unless the reader has the necessary punches.

The process of doing the lacing has been described a number of times in previous articles in Popular Science Monthly and is obvious from a study of the accompanying illustrations. The laces should be ⅛ in. or less in width. They may either be purchased or cut spirally from a piece of thin stock.

Go over the edges with a thin coat of shellac. After this is dry, polish the case with shoe dressing or floor wax.



The case opened. Any shoemaker or dealer in leather supplies will put on the two snaps



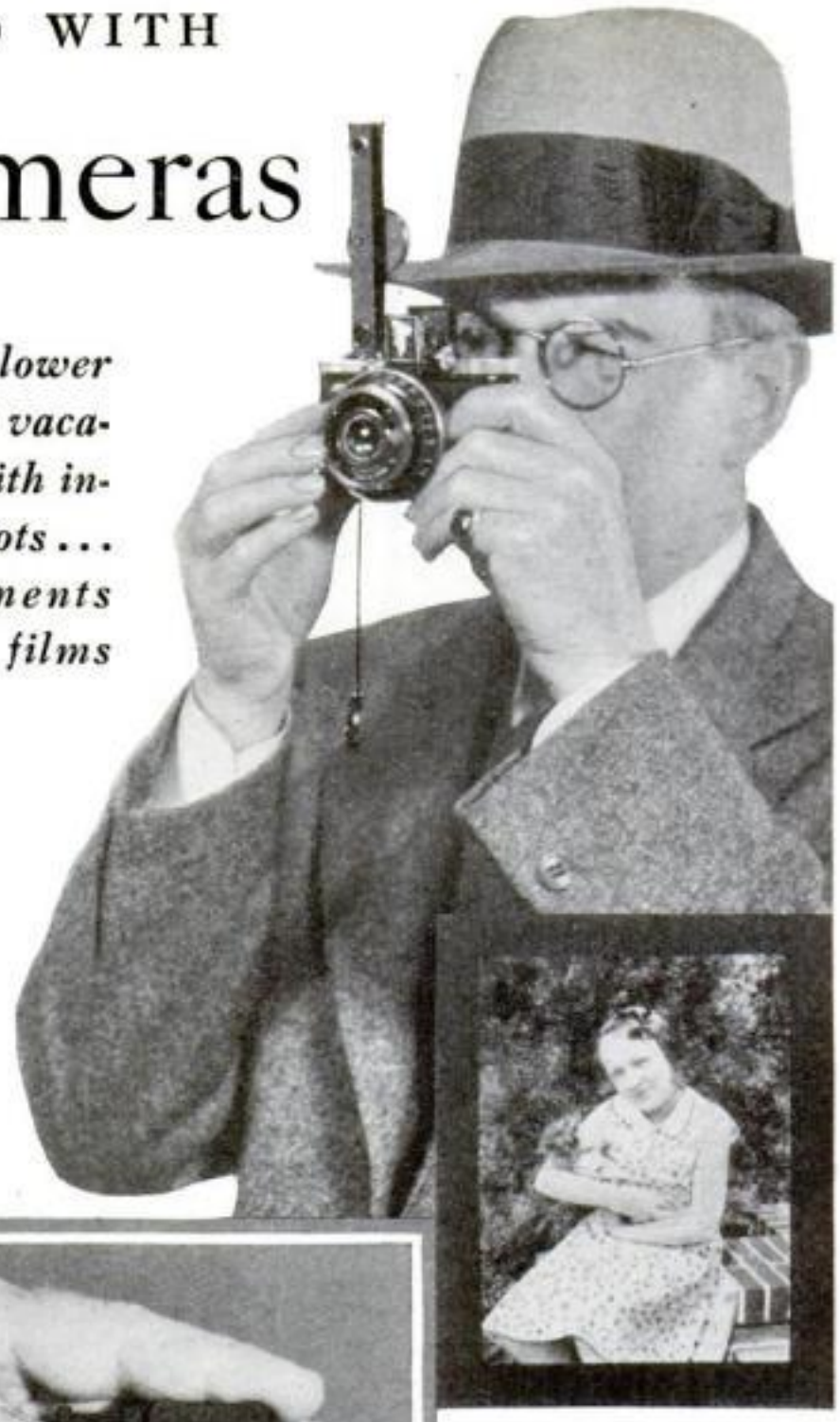
Patterns for cutting and punching the leather and celluloid, and sketches showing how the embossing and assembling are done

WHAT YOU CAN DO WITH

Miniature Cameras

Take more photos at lower cost . . . Brighten your vacation "memory book" with innumerable little snapshots . . . Have clear enlargements made from the best films

By
Frederick D. Ryder, Jr.



Lightness and compactness are combined in a miniature camera. You could carry one in your vest pocket if you had to

One of the highest class miniature cameras made for use with regular roll film, and the size photo it takes. The projecting column is a very accurate range finder

At left is another camera which has a fast focal plane shutter. With one loading of motion picture film, it takes thirty-six pictures like the sample shown. It has a novel built-in range finder which is synchronized with the lens focusing mechanism

YOU never can tell, when you start out, what the day will bring forth in the way of picture-taking opportunities. That is why you so often hear people say: "If I'd only had a camera along, I could have taken some wonderful snaps!"

It also is one of the important reasons why miniature cameras have recently become so amazingly popular. You never miss a chance for a good picture if you own an outfit so small you can take it with you wherever you go.

Another reason for the change to the smaller sizes is the vast improvement that has taken place in enlarging apparatus both for professional and home use.

A few years ago, nearly every amateur photographer preferred the post card size camera. He considered the 2¼ by 3¼ in. size much too small for serious work. Now a large number of amateurs take most of their pictures on film only a trifle bigger than an oversize postage stamp.

The idea of using a small camera and then making enlargements from the negatives is not new. Folding roll film cameras taking pictures measuring only 1⅝ by 2½ in. were introduced over thirty years ago. Various attempts have been made in past years to popularize cameras taking "still" pictures on motion picture film. The lack of suitable enlarging facilities already mentioned, coupled with the relatively poor results obtained because of the coarse-grained film then in use, however, were two severe handicaps.

Curiously enough, the original smallest size roll film now is used in nearly all of the tiny outfits we call miniature cameras. Instead of taking the original 1⅝ by 2½ in. picture, they split the picture area in halves and take two of approximately 1¼ by 1⅝ in. (3 by 4 centimeters). In consequence, the little cameras take sixteen pictures on the modern eight-exposure roll of film.

The method by which this doubling up of exposures is accomplished, without printing any additional numbers on the red paper backing of the film, is ingenious. Two round red celluloid windows are fitted to the back of the camera instead of the conventional single window. The photographer turns the film until number one appears in the first window. Then, after making an exposure, he turns the film until the same number appears in the second window. After the next "shot" he turns the key till number two appears in the first window, and so on.

The illustration on page 92 shows four typical miniature cameras. Note the pack of cigarettes placed at the end of the row to show how small are these tiny pieces of photographic apparatus.

The three models to the left use regular roll film to give sixteen pictures. The camera at the right end of the row is quite different in construction. It is fitted with a focal plane shutter and takes its pictures on standard 35-millimeter motion picture film.

The primary advantage of the miniature camera is, of course, its small bulk and light weight. No matter where you are going or what else you have to carry, one of these outfits will not appreciably add to the size or heft of your equipment.

It has been said that most of the miniature cameras can be placed in the vest pocket. This is true, as is shown in the circle at the head of this article. However, even if you can get a camera into your vest pocket, it is not a good place to carry it for two reasons. First, it is likely to drop out if you have occasion to bend over; and second, the heat and perhaps the perspiration of your body are harmful both to the film and the camera. The best

"That was the summer Betty was 3"

Make the memory last forever in Ciné-Kodak movies

"WE took a Ciné-Kodak along with us on our vacation. That was two years ago. I can't begin to tell you the fun we've had taking movies. And what a comfort it is to have these *living* pictures of the children. *Our* children can never grow entirely away from us."

Vacation is the time to start keeping a movie record. Happy days, exciting events, glorious moments that all too soon would fade into memory are yours to keep forever.

Ciné-Kodak M, priced at only $75, is as easy to operate as a simple snapshot camera. Aim. Press a lever. And that's all. We do the rest. Kodascope projectors are now as low as $50. Eastman Kodak Company, Rochester, New York.

Ciné-Kodak

Simplest of Home Movie Cameras

• IT'S SO EASY *to make clear, brilliant home movies with this simplest of home movie cameras. Aim . . . press the lever . . . and that's all. If you can make a snapshot, you can take a movie.*

$75 price of Ciné-Kodak Model M includes case

• CINÉ-KODAK MODEL M. *Into this compact little camera, Eastman has concentrated all the essentials of movie making. Equipped with f. 3.5 lens and a special attachment for close-ups. No focusing. Loads with full 100 feet of 16 mm. film.*

P. S. 8-32

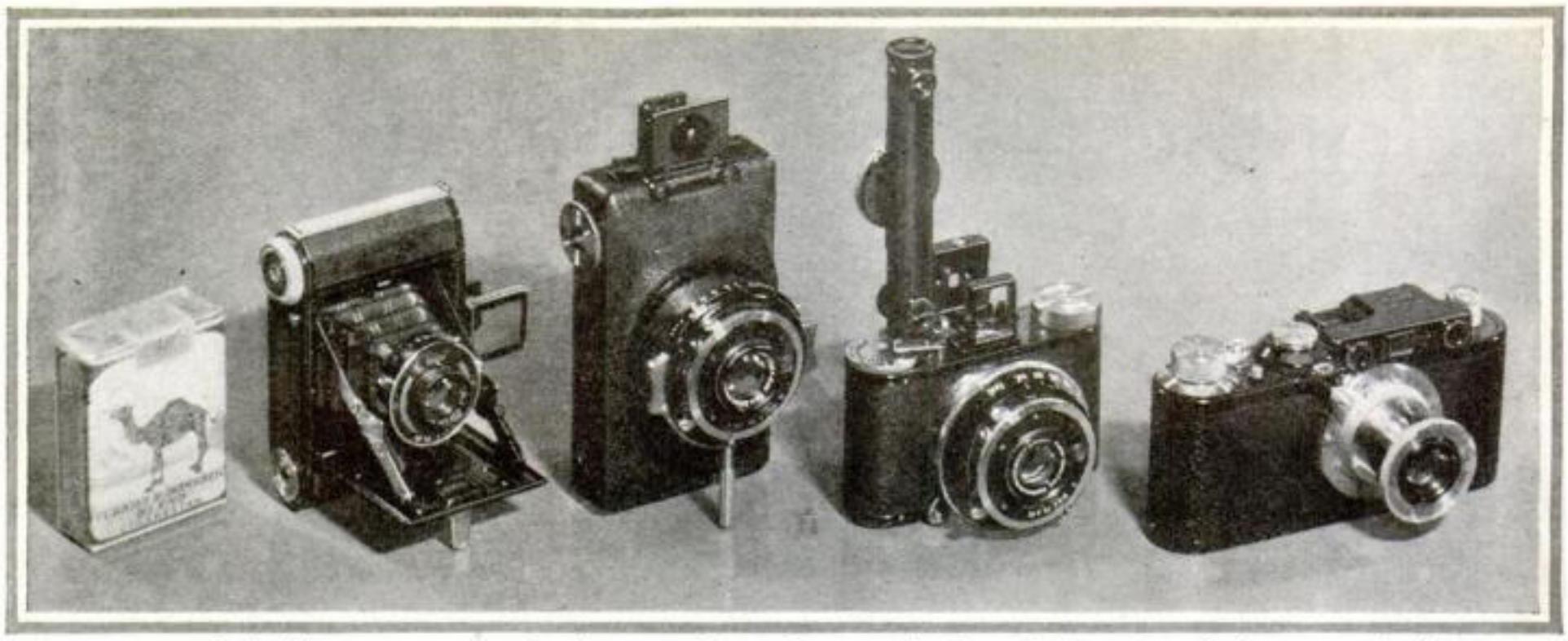
Eastman Kodak Company, Rochester, New York

Send me FREE illustrated booklet telling me all about making my own movies.

*Name*_____

*Street*_____

*City*_____ *State*_____



Four typical miniature cameras. How tiny they are can be seen by comparing them with the package of cigarettes at the left

way to carry a camera is in a carrying case, but if you must carry it in your pocket, the side coat pocket is most suitable. Be sure that the pocket is free from loose tobacco, lint, and dust.

Low cost of operation is a valuable feature of miniature cameras. You can take many pictures at the cost of only a few exposures of any larger size. If, for example, you take three snaps of the youngster with a miniature camera and get one worth keeping, it will cost you 4½ cents for the film used. If you take the same three snaps with a post card size camera and get one good, your film cost will be 26 cents, or nearly six times as much.

Furthermore, you stand a somewhat better chance of getting a good, sharp picture of the youngster with the miniature camera than you do with a larger size. The short-focus lens on the little camera has greater depth for the same stop opening. This means that without spoiling the picture you can make a greater error in judging focus with the miniature outfit than with a big one.

Improved apparatus and methods of enlarging have partly removed the principal objection to miniature cameras. Some users, however, find the small size of the contact prints and the extra trouble and time consumed in making enlargements a disadvantage when compared with the simple printing operation required with larger sizes.

On the other hand, many amateur photographers make up what they call a "memory book" consisting of a small size album containing prints of the pictures taken during a single vacation. Contact prints from negatives taken by miniature cameras are ideal for handy, pocket-size memory books.

The question is often asked as to how much actual loss there is in sharpness and clearness when the miniature negatives are enlarged. I have made numerous tests along these lines. For example, I have taken a distant view filled with microscopic detail such as twigs on distant trees, telegraph wires a long way off, and minute architectural structure on far-away buildings. In each test two exposures were made, one with a miniature camera and the other with a camera using 3½ by 4¾ in. (9 by 12 cm.) film. The same exposure, stop, and brand of film were used in each case to allow a comparison of results.

Both negatives were enlarged to approximately 5 by 7 in. on glossy paper to bring out all the detail possible.

Of course there was a difference—there always will be so long as photographic film has any grain at all—but the falling off in detail because of the tiny negative is astonishingly small. At normal viewing distance, it takes a sharp eye to note the trifling difference, and in practical amateur photography it doesn't amount to anything. These test enlargments have not been reproduced on these pages because such differences as exist would be virtually lost in the photo-engraving and printing processes.

Miniature cameras are made to fit every technical requirement and at various prices. In buying, keep in mind that a high-grade lens and careful and accurate construction are even more important in a miniature camera than in a larger size. Lens and camera defects show up glaringly when big enlargements are made from small negatives.

The row of cameras above does not by any means include all types. Many other varieties are available. It does, however, indicate the various classes.

The little folding camera at the left, next the pack of cigarettes, is fitted with a simple shutter and medium grade F/4.5 anastigmat lens. It sells for about $15, and that represents the practical minimum if you expect much in the way of enlargements. Next to it is a high-grade outfit of the pull-out lens type which can be bought with a medium grade F/4.5 anastigmat lens at $32.50 or with a high-grade F/3.5 lens at $52. This camera and the third in the row represent the highest class outfits made for regular roll film. The third camera sells at about $75 and is fitted with a detachable range finder (the vertically projecting column) so accurate that you can focus much more precisely than would be possible with a regular ground glass back, when working with a lens of such short focus. This camera also can be obtained with an F/2 lens. It is made by a prominent American camera manufacturer in a factory in Germany.

The miniature focal plane shutter camera at the right end of the row has some unique features. It uses standard size 35-millimeter motion picture film, the magazine holding about 5 ft. of it, giving a capacity of thirty-six double-frame size pictures before reloading.

It, too, is fitted with a range finder of the same optical type as shown on the third camera. On this camera the range finder is an integral part of the unit. It is operated by the motion of the lens in its spiral focusing *(Continued on page 103)*

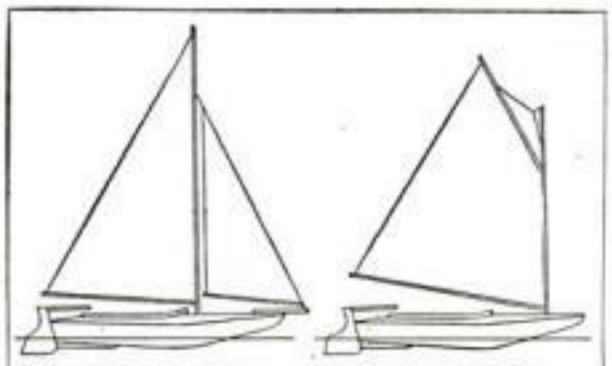
$10 for the Best Photo TAKEN WITH A SMALL CAMERA

FOR the most photographically perfect picture taken with a camera not larger than the 1⅝ by 2½ in. size and submitted on or before September 1, 1932, POPULAR SCIENCE MONTHLY will pay $10. The only condition is that it must be taken during the months of July and August, 1932, by an amateur. Any type of camera may be used, and the developing and printing may be done by a professional. Only contact prints should be submitted—not enlargements.

Mail both print and negative to the Photographic Editor not later than September 1, and mark your entry "August Photo Contest." You may enter several photos if you wish. No entries will be returned, however, unless accompanied by a self-addressed, stamped envelope.

The $10 prize for the best photograph entered in the eleventh contest in this series (P. S. M., Apr. '32, p. 111) has been awarded to H. Duquette, Hyannis, Mass. The following won honorable mention in the same contest: H. E. Battersby, Red Bank, N. J.; Tillie Boese, Jefferson, Wis.; C. H. Clapper, Hudson, N. Y.; P. A. Kinsey, Boyertown, Pa.; Edwin Efros, Bronx, N. Y.; Francis C. Jones, Brooklyn, N. Y.; D. H. McClain, Cincinnati, Ohio; Paul G. Shippee, Fresno, Calif.; Edward J. Steitz, Brooklyn, N. Y.; Jim Stubbs, Boulder, Colo.; Fred A. Tomlin, Lebanon, Ill.; R. E. White, Drayton Plains, Mich.; Sam Zito, Niagara Falls, N. Y. The winner of the May contest will be announced next month.

A MARCONI RIG FOR OUR SAILBOAT-MOTORBOAT



NOS. 131, 132, 133 A MARCONI RIG

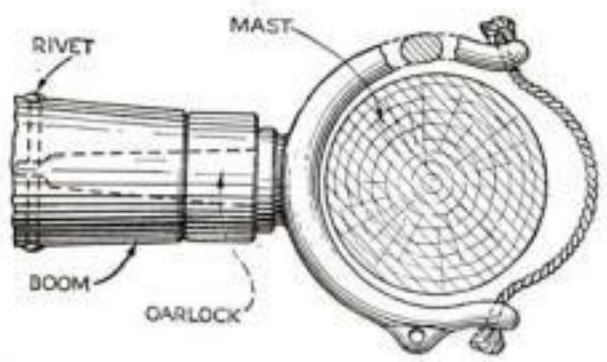
NOS. 131, 132, 133 CATBOAT RIG

FOR those who wish to construct the POPULAR SCIENCE MONTHLY combination sailboat-motorboat with a Marconi rig and jib instead of the conventional catboat rig, a special blueprint has been prepared. In ordering this rigging plan, ask for special Blueprint No. 133A; the price is 25 cents.

The boat has already been constructed by many readers with great success. It is an excellent general utility boat because it can be rowed, sailed, or driven by an outboard motor. The complete plans with the catboat rig are given on Blueprints Nos. 131, 132, and 133-R, and with the Marconi rig on Blueprints Nos. 131, 132, and 133A-R. The price is the same in each case—$1.00.

No matter which rigging plan you use, the work of building the hull will be greatly simplified if you have a complete set of full size patterns. These can be obtained from the Blueprint Service Department for an additional $1.50. A coupon for ordering is given on page 96.

BOOM JAWS MADE FROM LIFEBOAT OARLOCKS



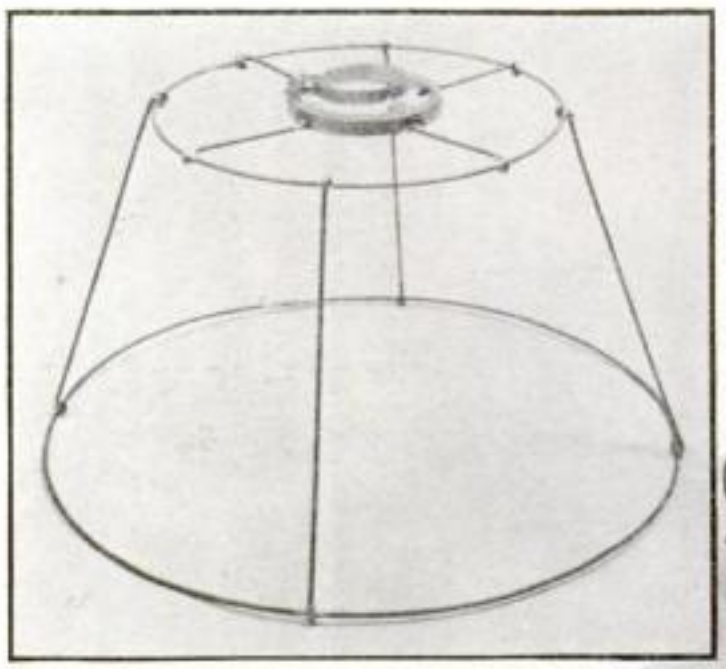
NEAT boom jaws for a small sailboat can be made easily from the oarlocks of a lifeboat. These are obtainable at any large marine hardware store and can be purchased along almost any water front at a nominal price. Bore a hole in the end of the boom slightly smaller than the shank of the oarlock to be used. Fit a snug ferrule at the end of the boom to prevent the wood from splitting when the oarlock is driven into place.—VIGGO J. THOMSEN.

TO RECEIVE ATTENTION every inquiry relating to articles published in POPULAR SCIENCE MONTHLY *must be accompanied by a self-addressed, stamped envelope. It is important that the questions be brief and to the point. Mention the article, the page, and the issue of the magazine to which reference is being made.*

AN EASY WAY TO BEND AND ASSEMBLE

Wire Lamp Shade Frames

By Edward Thatcher



This homemade frame is as perfect as the factory article. *Right:* Assembling the parts of the frame on a wooden form

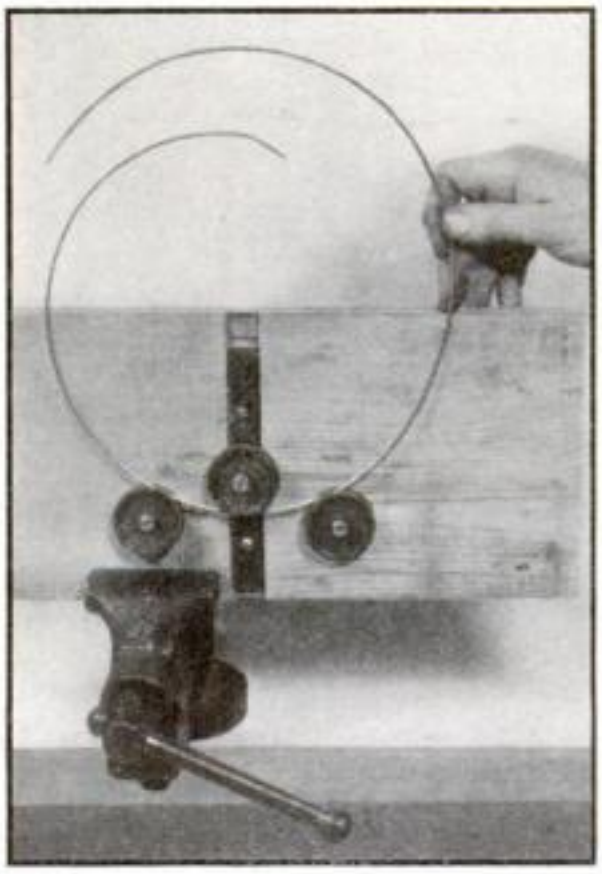
ALMOST everyone who has tried to make up a wire lamp shade frame has had some difficulty in finding just the right form around which to bend the wire hoops and in assembling the frame so that it compares favorably with the commercial product. With the simple equipment shown, these frames can be made quickly and easily in any reasonable size.

The hoop forming machine consists of three iron sash pulley wheels removed from their frames and fixed to a board in such a way that the upper one is adjustable up and down, yet free to revolve. The grooves of all three wheels must be in line with each other.

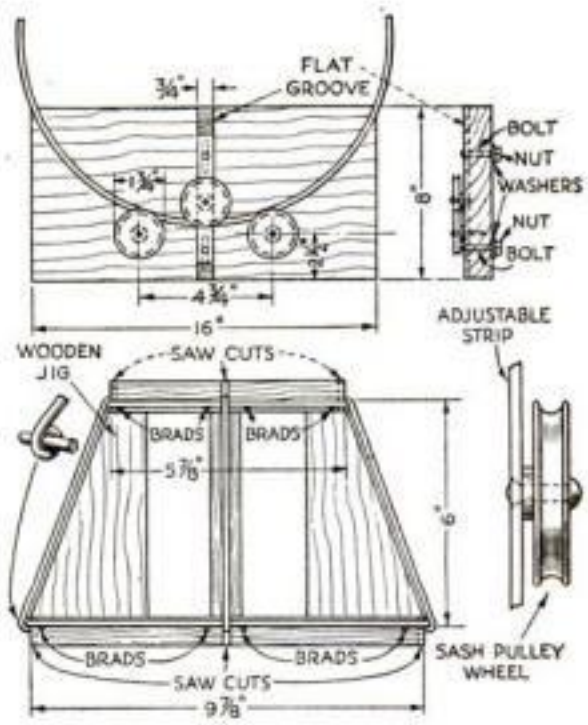
A length of wire is cut about three and a half times the diameter of the desired hoop. The wheel in the center is adjusted between the two outer wheels so that when the wire is gently pushed through, it will form naturally into a circle as shown. Before starting the wire through the rolls, one end of it should be slightly bent up; it will then ride up over the third or outer pulley. Afterwards this bent end may be cut off. Soft iron, copper, or brass wire up to 3/16 or even ¼ in. in diameter, as well as brass or copper tubing up to the capacity of the pulley wheels, may be formed into loops in this way without difficulty.

To join the wire hoops together, they are first placed around their respective wooden forms and the ends cut so that they meet in a butt joint. A thin strip of tin or brass is rolled about a section of the wire to form a cylinder about ½ in. long. The ends of the hoop are pushed in the ends of this cylinder and soft soldered to form the joint.

The wire lamp frame illustrated is 10 in. in diameter at the base and 6 in. at the top, and it is 6 in. high. In order to assemble one or more of these frames, quickly and accurately, a wooden form is constructed as shown. On this form or jig the two wire hoops are placed, after being loosely connected with the four wire uprights. The ends of these uprights are merely bent around the hoops, and the bent ends are held in saw slots cut for them where necessary in the wooden form. A few small brads are driven to hold the hoops in position for soldering. One of the photographs shows how the shade holder is fastened in place by centering it on the upper wooden disk and soldering



it to the four supporting wires. The ring about the holder is notched or drilled to receive these wires. Shade holders such as the one shown may be purchased at electrical supply shops or the electrical departments of chain stores.

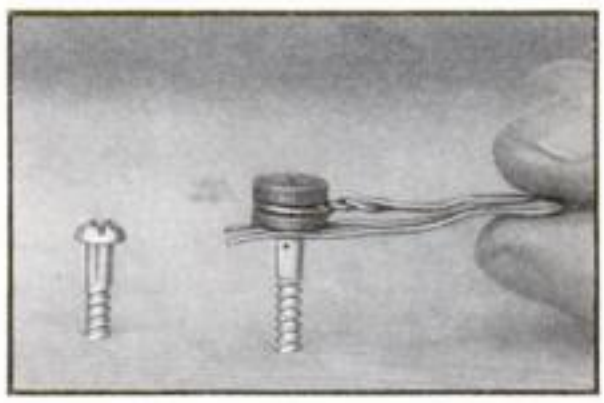


At left: Bending fixture in which the hoops are made by pushing the wire between rollers. *Above:* Drawings of bender and form

If a number of shades are to be made, it will pay to obtain tinned wire similar to that from which commercial shades are made. Your tinner or hardware dealer will probably be able to order it for you. Galvanized wire about 1/16 in. in diameter was used for the frame illustrated, and it is sold at most hardware stores.

CAP AIDS IN STARTING ROUNDHEAD SCREWS

A DRIVING cap for starting roundhead brass or nickel plated screws without denting the slot or otherwise marring the head can be made from an old dry battery terminal nut. The underside of it is already cupped so that it will cover the head of any small screw. A short length of wire is wrapped around the groove in the nut and twisted; then the ends of the wire are bent back so that they project beyond the nut as shown to form two prongs or clips to go under the head of the screw and hold it while it is being tapped into place.—FRANK W. BENTLEY, JR.



A protective cap used when roundhead screws are started by tapping them with a hammer

PARROT FLOWER HOLDER FOR USE ON PORCH

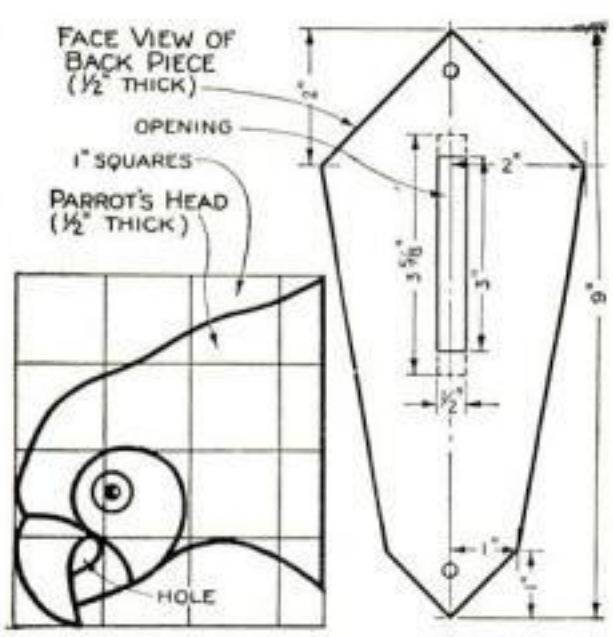
Novel support for a hanging vase or jar

THE materials needed for making this colorful little porch flower holder are a piece of ½-in. wood, a small vase, a bit of cord, and enamel or lacquer.

Mark out a pattern for the back of the holder according to the diagram below. To make the pattern for the parrot's head, draw a rectangle 3½ in. wide and 4 in. high and mark it into 1-in. squares, leaving the ½ in. wide spaces at the right. Then draw the lines of the head through the squares as shown. The part in the ½-in. spaces is to be set into the backpiece.

Cut out the patterns carefully, mark around them on ½ in. thick wood, and then saw out the two shapes. Make a hole in the parrot's bill where indicated, and bore a small hole near each end of the backpiece by which it may be fastened to the wall.

Chisel an opening in the backpiece to receive the end of the parrot's head. This



The parrot's head drawn on squares for easy enlargement, and a diagram of the backpiece

opening will be about 3 in. long on the front of the backpiece and 3⅝ in. on the other side, and the width will be ½ in. The head should fit very tightly and should be glued in place. Since the head is larger at the back, the weight of the vase cannot cause it to loosen or pull away from the backpiece.

Enamel the parrot's head green with a white spot on each side, and the bill and the backpiece yellow, or make the parrot's head red and the backpiece green. The vase, which may be bought at a ten-cent store or may be a decoratively shaped bottle or pickle jar, should be enameled green. It should hang suspended from the parrot's bill just below the end of the backpiece.—H. S.

HOME WORKSHOP BLUEPRINTS

For this month's new blueprint projects see pages 64, 72, and 76

TO ASSIST you in your home workshop, POPULAR SCIENCE MONTHLY offers large blueprints containing working drawings of a number of well-tested projects. The blueprints are 15 by 22 in. and are sold for 25 cents a single sheet (except in a few special cases). Order by number. The numbers are given in italic type and follow the titles. When two or more numbers follow one title, it means that there are two or more blueprints in the complete set. If the letter "R" follows a number, it indicates that the blueprint or set of blueprints is accompanied by a special reprint of the instructions originally published in the magazine. If you do not wish this reprint, omit the letter "R" from your order and deduct 25 cents from the price given. Reprints alone are sold for 25 cents each.

Flying Airplane Models

Bremen (Junkers, 3-ft. Flying), *89-90*	$ .50
Combination, 20-in-1, *135-136*	.50
Lindbergh's Monoplane (3-ft. Flying), *69*	.25
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Seaplane, Morris (Record 12½ min.), *102*	.25
S. E. 5a World War Plane (30-in.), *168-169*	.50
Single Stick, Tractor, 30-in., *82*	.25
Tractor (Record Flight 6,024 Ft.), *104*	.25
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Boats

Canoe, Sailing Outfit, *25*	.25
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With full size patterns	2.00
Outboard Racer, 11½-ft., *128-129*	.50
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With full size patterns	2.00
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15½-ft. Runabout or "Sportboat" (outboard or inboard motor), *175-176-177*	.75
With full size patterns	2.25

Furniture

Bookcase, Modernistic, *88*	.25
Bookcase, Simple, *37*	.25
Bookshelf and Book Ends, Modernistic, *107*	.25
Bookshelves, Hanging, *77*	.25
Bookstand, Modernistic, *88*	.25
Book Trough, *68*	.25
Cedar Chest, Mahogany Trimmed, *17*	.25
Chair, Rush-Bottom, *36*	.25
Chests, Treasure, *78*	.25
Clock, Grandfather, *19*	.25
Desk, Colonial, *21*	.25
Desk, Sheraton Writing, *40*	.25
Dresser, Welsh, *60*	.25
End Table, Magazine, *68*	.25
Kitchen Cabinet, *5*	.25
Kitchen Table Cabinet, *27*	.25
Lamps, Modernistic, *93*	.25
Mirror, Scroll Frame, *105*	.25
Muffin Stand, Folding, *173A-174A*	.75
(See page 97 for kit of materials)	
Pier Cabinet and Corner Shelves, *77*	.25
Radio Cabinet, Console, *70-71*	.50
Screens, Modernistic Folding, *91*	.25
Sewing Cabinets, Two, *31*	.25
Sewing Table, *1*	.25
Shelves and Lamp, Modernistic, *93*	.25
Smoking Cabinet, *2*	.25
Stand, Low Modernistic, *100*	.25
Table, Gate-Leg, *24*	.25
Table, Tavern, *105*	.25
Table, Tilt-Top, Oak (Top 20 by 24 in.) *140*	.25
Tea Wagon, *13*	.25
Telephone Table and Stool, *18*	.25

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Constitution ("Old Ironsides"), *57-58-59-R*	1.00
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Destroyer—U. S. S. *Preston* (31½-in. Hull), *125-126-127-R*	1.00
Galleon, Spanish Treasure, *46-47*	.50
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Schooner—*Bluenose*, *110-111-112-R*	1.00
Sedan Chair, Queen's, *123-124*	.50
Stagecoach, Concord, *115-116-117-R*	1.00
Stagecoach (Cody), Small, with Horses, *144-145-146-R*	1.00
Steamboat, Mississippi, *94-95-96-R*	1.00
Viking Ship, *61-62-R*	.75
Weather Vane, Ship Model, *66*	.25
Whaling Bark *Wanderer*, *151-152-153-154*	1.00
(See page 97 for kit of materials)	
Yacht, *Sea Scout*, 42-in. Racing, *106-107-R*	.75
Yacht, 20-in. Racing, *48-R*	.50

Toys

Airplane Cockpit with Controls, *114*	.25
Birds and Animals, *56*	.25
Doll's House, Colonial, *72*	.25
Doll's House Furniture, *73*	.25
Drill Press, Woodturning Lathe, Jointer, and Circular Saw, *113*	.25
Dump Truck, Sprinkler, Fire Engine, and Tractor, *101*	.25
Lindbergh's *Spirit of St. Louis*, *67*	.25
Play Table, Pullman, *28*	.25

Miscellaneous

Arbor, Gate, and Seats, *9*	.25
Baby's Crib and Play Pen, *26*	.25
Camping Trailer, Collapsible, *167A*	.50
Camping Trailer, Tent Type, *171A-172A*	.75
Garage, One-Car, Pergola, *23*	.25
Log Cabin (Three Rooms), *134*	.25
Puzzles, Six Simple Block, *65*	.25
Swing, Porch, *10*	.25
Tool Cabinet, Bench Hook, etc., *30*	.25
Trellises, Garden, *34*	.25
Workbench, *15*	.25

Popular Science Monthly
381 Fourth Avenue, New York

Send me the blueprint, or blueprints, numbered as follows:

No..... No..... No..... No.....

No..... No..... No..... No.....

Patterns for .....

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I am inclosing.....dollars.....cents.

Name .....

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Note: Please print your name and address very clearly. If you do not wish to cut this page, order on a separate sheet.

Economical and Timesaving

Construction KITS

for your home workshop

KIT NO. 4

AS A SERVICE to readers who find it difficult to obtain suitable materials for building high-grade furniture and models, the Popular Science Homecraft Guild has assembled the kits listed below.

The numbered kits, which are also marked "ready to assemble," contain the completely machined wooden parts, the necessary hardware, and the Guild finishes. The other kits, identified by letters, contain the raw materials alone (without paints or finishes) and are for craftsmen who wish to do all the work themselves. All kits are accompanied by instructions or blueprints. Because of heavy shipping charges, the prices are 50 cents higher west of the Mississippi River.

KIT NO. 1

KIT NO. 2

KIT A

KITS B AND C

No. 1. Colonial maple butterfly table with oval top 17 by 22 in., and 22½ in. high. Ready to assemble..... $6.90

No. 2. Solid mahogany tray-top table 23 in. high with a 15 in. diameter top. Ready to assemble..... 5.90

No. 3. Tilt-top coffee table in selected maple with top 19 by 28 in., and 21 in. high. Ready to assemble..... 7.15

No. 3A. The same table in solid mahogany. Ready to assemble..... 8.15

No. 4. Solid mahogany book trough 22½ in. long, 9½ in. wide, and 24¾ in. high over all. Ready to assemble..... 5.30

A. Whaling ship model *Wanderer*. All the raw materials—wood, sheet brass, and copper, five sizes of wire, four sizes of fishing line, fine chain, celluloid, and everything but the paints, together with Blueprints Nos. 151, 152, 153, and 154..... 6.90

B. Folding muffin stand in selected sugar pine, 11 in. wide, 19 in. long and 33 in. high when open. All the necessary wood cut to approximate sizes but not machined in any way, together with the screws..... 2.90

C. Muffin stand in birch (can be finished as maple, walnut, or mahogany)..... 2.90

KITS NOS. 3 AND 3A

Popular Science Homecraft Guild,
381 Fourth Avenue, New York, N. Y.

Please send me the following kit or kits, for which I inclose $..... (or send C. O. D. ☐)

☐ No. 1.	$6.90	☐ No. 4	$5.30
☐ No. 2.	$5.90	☐ A	$6.90
☐ No. 3.	$7.15	☐ B	$2.90
☐ No. 3A.	$8.15	☐ C	$2.90

All prices are 50 cents higher west of the Mississippi River because of heavy shipping charges. This offer is made only to readers in the United States.

Name .....

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GOLD HUNTER STRAYS FROM FAVORITE SMOKE

But Radio Message Brings Ontario Man Back into the Fold—to Stay!

FAR away in North Bay, in Ontario, Canada, Mr. Thomas Hall listened to a radio program from "the States." It seemed to Mr. Hall that an old friend was speaking, a friend he'd long neglected in his search for gold in distant lands. Not five minutes after the close of that program, Mr. Hall was again in touch with his old friend. But let this letter tell you, in Mr. Hall's own words, the story of his happy reunion.

North Bay, Ontario, Canada
February 18, 1932

Edgeworth
Richmond, Va., U. S. A.
My dear Sirs:

Listening to your excellent broadcast tonight, I cannot resist the urge to write you. This urge is kindled by remorse that I have strayed from the "straight and narrow" path that should have been trodden by me since first I smoked your entrancing weed.

From London, England, by way of Shanghai, Singapore, Mombasa, Odessa, Algiers, Las Palmas, Sydney, N. S. W., and Montreal to this small but busy city is a long route and a far cry. Eventually reaching the lands where the Ogoki joins the Albany, ever in search of the yellow metal, I lost track of Edgeworth. I forgot the delicacy and the satisfaction of the tobacco that once was all to me.

Within five minutes of the closing of your program, I telephoned a good friend and this is what I said: "Hello, Tom, have you any Edgeworth in stock?" And he replied, "Sure I have." Well, I ordered a stock and tonight I shall sleep all the sounder, knowing what the morrow is bringing.

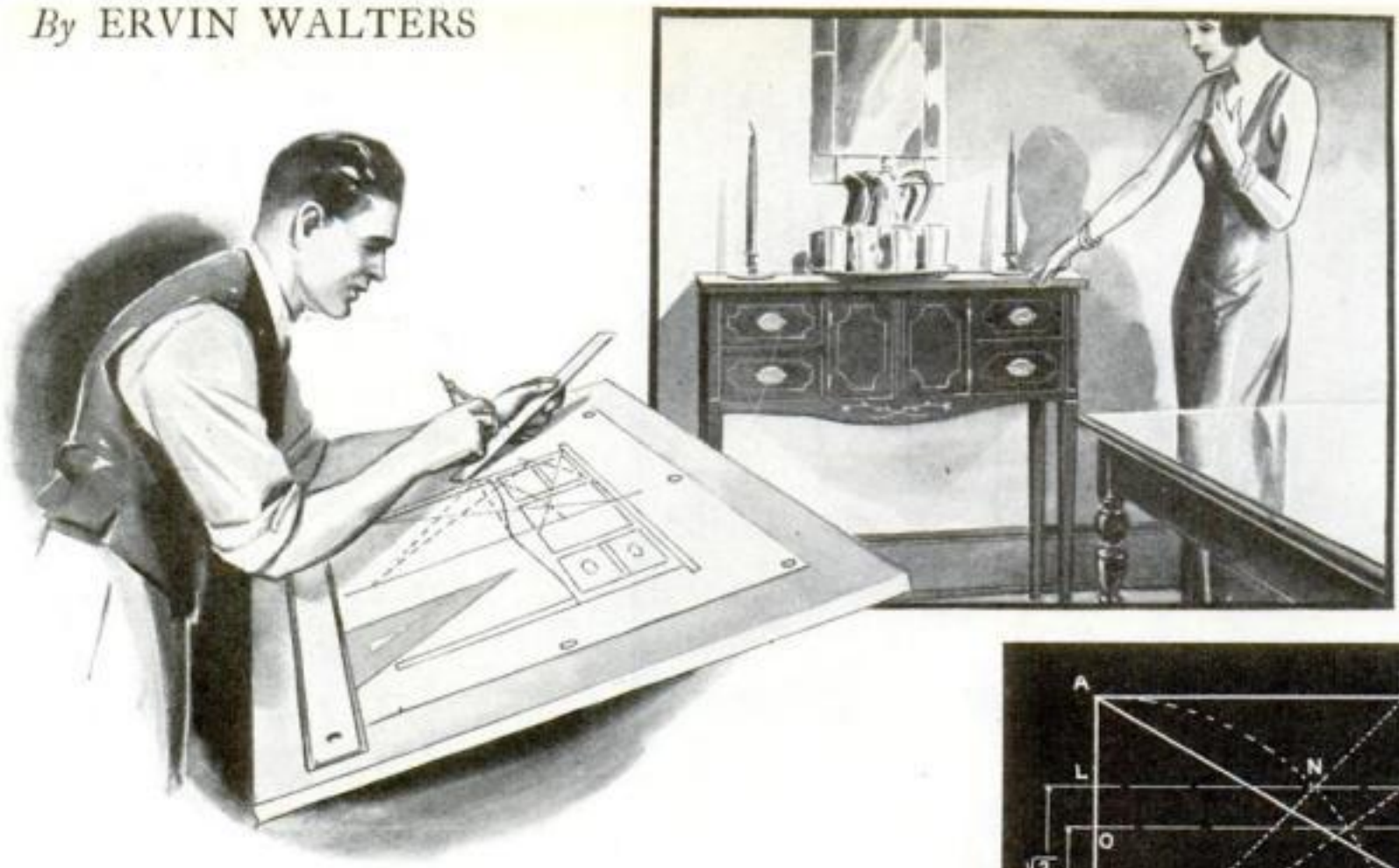
I have returned to the good old "straight and narrow."

Cheerio,
Thomas Hall

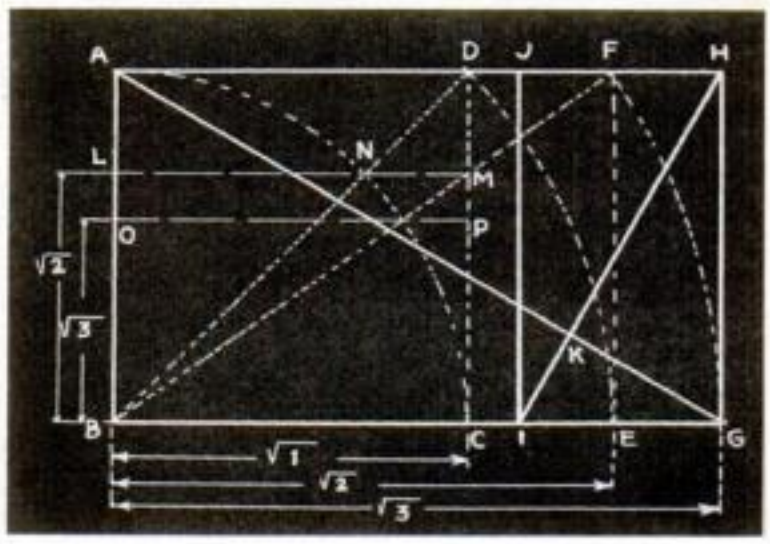
Pipe smokers everywhere will understand Mr. Hall's enthusiasm at the re-discovery of his old friend—Edgeworth.

Are you entirely satisfied with your present tobacco? Is it as slow-burning and cool and flavorful as you'd like it to be? If not, perhaps you yourself should try Edgeworth. Edgeworth is different—a blend of rich burleys in which the natural savor is retained. Your name and address, sent to Larus & Bro. Co., at 110 S. 22d St., Richmond, Va., will bring you a free sample packet of Edgeworth. You can buy it in vacuum sealed tins—or in the famous 15-cent pocket packages in Ready-Rubbed or Plug Slice Form. Put Edgeworth in your pipe and smoke it.

By ERVIN WALTERS



By following a few simple directions, the home craftsman can design his own original projects with the assurance that the parts will be in proportion. *Below:* Fig. 1. The first step in working out a design by dynamic symmetry. The square is the starting point.



This simple system of diagrams teaches you to

Design the Things You Build

To turn out pleasing, well-proportioned original projects in your home workshop —whether in wood, metal, or any other material—you have to be more than a good mechanic; you must be a good designer as well. It's lack of skillful designing, not poor workmanship, that gives so much amateur work an unmistakably homemade look. Yet the knack of making presentable designs is easily acquired. It doesn't require great talent, artistic skill, or a lot of study—merely a knowledge of how to use the few diagrams that Mr. Walters explains in this article.

WHAT is the one great secret of success in the home shop? "Good craftsmanship," you may say. That is by no means true if you mean merely the acquiring of mechanical skill with tools. A man may be a very clever craftsman and still turn out projects which have little value. You have undoubtedly seen the work of such men yourself—perhaps a table lamp, a radio cabinet, an end table, or a rose trellis. Whatever it was, you were able truthfully to congratulate the builder upon his neat and careful workmanship while at the same time you said to yourself that you wouldn't want the finished product even as a gift, it was so top heavy, "squatty," cumbersome, or otherwise unsatisfactory in design.

The most important factor, therefore, is the basic design. The proper arrangements of its parts will make a cow barn pleasing to the eye, while faulty design will spoil the appearance of a diamond necklace. The proportions must be right or all embellishments are so much wasted labor.

There is one very simple way to make good designs—a system so easy and foolproof that every craftsman should know how to use it. This was developed by the ancient Greeks, and it can be applied to the designing of anything from a book end to a bungalow, or to the arranging of pictures on a wall surface, or to doing anything else in which the appearance is a factor. While the method has been given the rather formidable name of "dynamic symmetry," it is not nearly as difficult as it sounds.

Dynamic symmetry is a matter of area. The design itself can be any size, as long as the areas and their boundary lines are in pleasing proportion. You can work out a plan for a piece of furniture in any of a limitless number of forms.

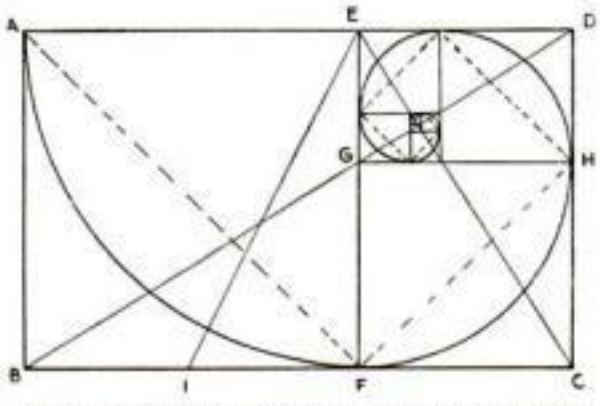


Fig. 2. "The whirling square rectangle" forms the basis for a rhythmic Greek curve.

Drawing a rectangle is the first step. The Greeks found that certain rectangles are of more pleasing proportions than others. The ratio of the length to the breadth could be represented by the square roots of numbers, so they called these rectangles "roots." Look at Fig. 1. The square *ABCD* is the starting point, and is itself one of the pleasing rectangles and is known as Root 1. Draw the diagonal *BD*. Place a compass point on *B* and with *BD* as a radius draw the curved line *DE*. Extend the base and top lines of the square to the right. At the point *E* where the curved line strikes the base line, draw *EF* parallel to *CD*, and extend the top line of the square to meet *EF*. The rectangle *ABEF* is the second dynamic rectangle, and is known as Root 2, because the length divided by the width equals the square root of 2 ($\sqrt{2}$). In this way you can work out rectangles of increasing length for a given breadth. Root 5 or 6 is about as far as you need go for most purposes.

There is a method of constructing rectangles of the same proportions *inside* the basic square, the length being the constant dimension rather than the width as in the above construction. Look at Fig. 1, considering only the square *ABCD*. Draw the arc *AC* and the diagonal *BD*. At the point *N* where the arc and diagonal cross, draw *LM* parallel to the side

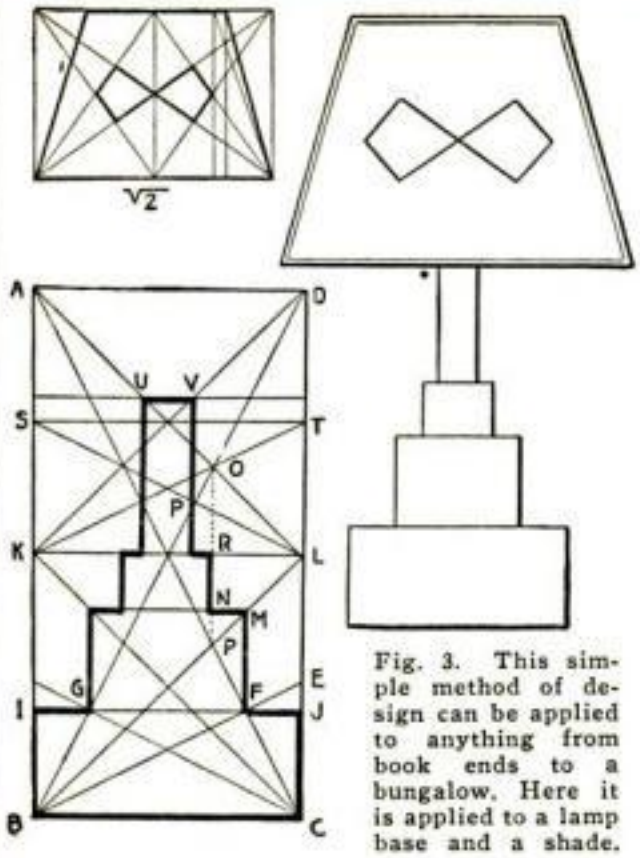


Fig. 3. This simple method of design can be applied to anything from book ends to a bungalow. Here it is applied to a lamp base and a shade.

AD. The figure *LBCM* is Root 2. Repeat the process by drawing the diagonal of Root 2 and the parallel line, and you get *OBCP*, which is a Root 3, and so on indefinitely.

Now that you have a rectangle whose length is in pleasing proportion to its breadth, you must divide it up into smaller areas whose proportions are equally pleasing. Do this by drawing diagonals, perpendicular lines, arcs of circles, and parallel lines. The points where some of these lines cross are the points of greatest interest in the rectangle. They represent the position at which an object should be placed if you want to call attention to it in particular. The exact center of the area is the point of strongest interest, but it should be avoided in general because it detracts from other points of interest. Thus, if you place a picture in the center of a wall, it will receive more than its share of attention.

Figure 1 also shows the starting points for working out many designs in dynamic symmetry. Consider only the solid lines. The rectangle *ABGH* is a Root 3. Draw the diagonal *AG*, and the line *HI* perpendicular to it through the corner *H*. The point *K* is a center of interest. Draw the line *JI*, and the resulting rectangle *JIGH* is also a Root 3, in smaller size but the same proportions as the original figure.

Examine the figure carefully and you will see that the line *HI* and its perpendicular through *K* form exactly the same arrangement inside the smaller rectangle as *AG* and *HI* do inside the larger. This process can be repeated for each of the four corners of the original figure, and for any of the subdivisions. But you usually need construct such lines only at places where you desire to work out some detail of the object you are designing. The process of dividing a rectangular area is limitless, but you preserve the proper proportions of parts as long as you use only diagonals, parallel and perpendicular lines, mid-points of lines, and arcs of circles.

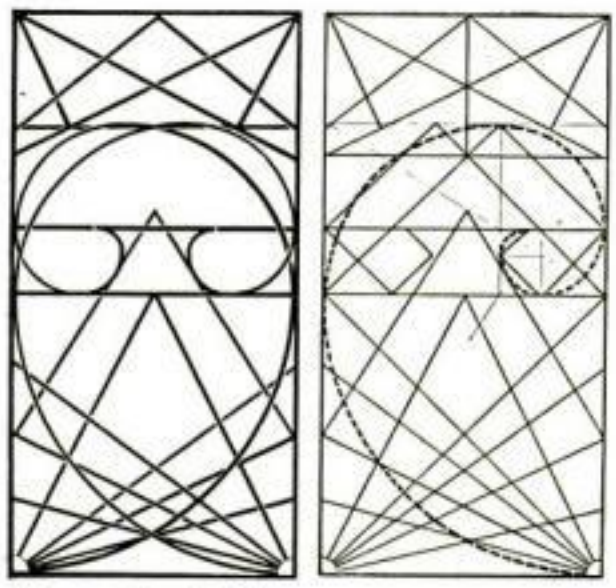
There is a figure halfway between Roots 2 and 3 that is of particular interest. It has been given various distinguishing names, such as the golden or whirling square rectangle. It is formed by drawing a square, locating the midpoint on the base line, as at *I* in Fig. 2, and using this as a center for drawing an arc with *IE*, the diagonal of half of the square, as a radius. Thus the point *C* is found, and the rectangle *ABCD* drawn.

Now watch this: Draw the usual diagonal *BD* and its perpendicular *EC*. The side *EF* of the original square strikes the side *AD* at the same point as the perpendicular *EC*. The rectangle *CDEF* is a smaller version of *ABCD*. So you can draw *GH* at once, forming the square *FCHG* and the smaller rectangle *EGHD*. Continue this process until the areas become too small to work with easily.

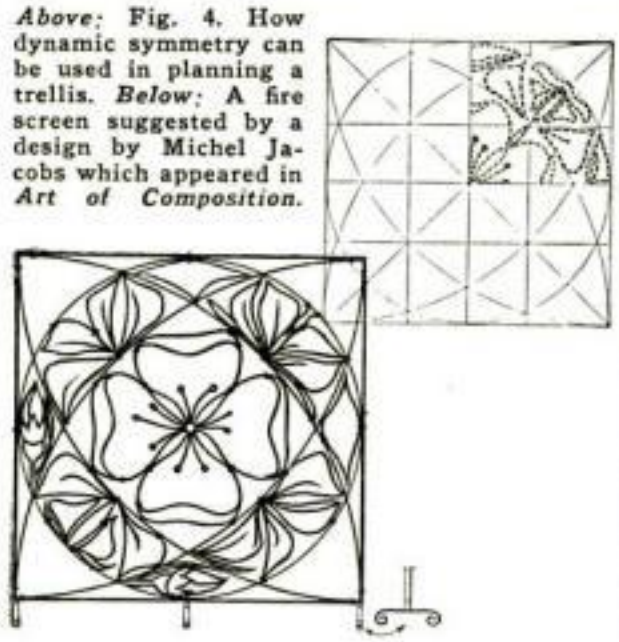
Then, beginning at *A*, draw diagonals as shown through every one of the squares, the end of one joining the end of another in each case. This gives a sort of whirling figure with straight sections. Now, with a compass, draw quadrant arcs which intersect the diagonals at the corners of the squares. The radius of each arc is the side of the square in which it lies.

These arcs, each of a successively smaller radius, join each other to form the well-known Greek rhythmic curve. You will find it useful. Can't you imagine the curve forming part of a chair arm, the foot of a stool, or portion of a lamp base? If you are modernistic in your tastes, use the straight-sectioned whirl.

It is hoped that this will give you a satisfactory introduction to the vast field of dynamic symmetry. By trying some of the constructions, you soon will become familiar with the principles of the method (see Figs. 3 and 4).



Above: Fig. 4. How dynamic symmetry can be used in planning a trellis. *Below:* A fire screen suggested by a design by Michel Jacobs which appeared in *Art of Composition*.



MAKING SAILS FOR YOUR SHIP MODELS

(Continued from page 74)

bend the inner end sharply, drive it into the yard, and paint it black. It does not quite reach the middle or the ends.

There must, of course, be holes just inside the brace bands large enough to take the sheets of the sails above. For these sheets place blocks amidships under the yards. The blocks should be metal if the sheets are chain, and wood if the sheets are rope. There is also a block underneath, slightly abaft, on each side for the clew lines.

To the jackstays of courses and single topsails, three small blocks should be seized on either side for the buntlines *(B)* and leech lines *(L)*—for both double topsails and topgallant sails, two on a side; for royals and skysails, one on a side.

To the under-fore-edge of the tops, bolt or seize three single or one double and one single block on each side, and do the same under the crosstrees for the buntlines and leech lines. For a lower topsail and the upper sails, seize them under the shrouds.

On the yards you may legitimately use bull's-eyes instead of blocks. This is one place in which small beads might be used. As this running gear varies from about ½ to 1 in. in diameter, you are not likely to have any of it too thin or your blocks too small.

The sail is stretched to the yard with the head "earrings" of thread carried to the braceband eyes, with a complete turn around the yard. It would also really have a roving (piece of yarn) at each seam, and between seams, carried to the jackstay, but it is best to hitch it with needle and thread.

Having fixed the sail, tighten up the halyards, bring the clews down with the sheets, and belay them. With a needle hitch the leechlines *(L)* and buntlines *(B)* to the edges of the sails as shown; reeve them through the yard leads; through the blocks above, and down abaft to the pinrail of the bulwarks. Start the clew lines *(C)* at the heel of the quarter blocks and carry them through hook blocks hooked to the clews (abaft), through the quarter blocks, and, in the case of the courses, down through the lubber holes to the fife rails. In the case of the clew lines above, carry them to the pinrail.

Reef tackles were seldom shipped unless in bad weather, so are better omitted.

The yard lifts hang down abaft when the yards are hoisted, but the topping lifts of the lower yards are tight as always, keeping the whole series horizontal.

The clews of the courses are tacks when to windward and forward. They have a permanent single rope (lazy tack), which, in the case of the foresail, is finally fixed with a chain or tackle to the cathead, and, in the case of the mainsail, to a bolt extending from the deck and having an eye above the pinrail. On the lee side the clews are sheets, which are heavy ropes hooked to a bolt in the ship's side at the deck level, outside; they pass through a heavy block at the clew and through a sheave in the bulwarks abaft the rigging, and are belayed to a pin.

Next month we shall describe the fore-and-aft sails and give some hints on clewing up, furling, and stiffening.

ADDING THE FITTINGS TO OUR *SPORTBOAT*

(Continued from page 80)

windshield coaming where it joins the deck.

The upholstering may now be done. Tack the chicken wire to the seat frames, stretching it tightly. Cut the wire even with the frame. Lay thick cotton batting over the wire and trim it even with the edge of the frame. Cover the frame with burlap, pressing the cotton down firmly. Then start tacking the imitation leather along the underside of the seat bottoms. Cover the backs by stretching the leather over cotton batting.

The top is covered in much the same way, except that canvas instead of wire mesh is stretched smoothly over the framework and tacked along the edges. Over this is laid cotton batting—the kind used to make quilts. Trim it even with the edge of the stringer. Tack the imitation leather, beginning at one corner, and stretching it smoothly over the top. Smooth away all wrinkles and tack it along the bottom edge of the stringer. When finished, fasten gimp over the edge so as to cover the heads of the tacks. For this, use large-head upholstery nails.

The top is held to the stanchions with plywood gussets as shown on the plans. The gussets are fastened to the stringer with 1¼-in. No. 6 F.H. screws. The stanchions are fastened to the lower part of the gussets with 1½ by ¼ in. carriage bolts with wing nuts. The stanchions at the lower edge are fastened to the coaming with 1¾ by ¼ in. carriage bolts and wing nuts.

The seat backs are joined to the seats with a continuous hinge fastened with ⅝-in. No. 6 F.H. screws.

The seat brackets are made from 1 by ⅛ in. strip brass. The upper end is fastened to the seat back with one 2-in. No. 12 R.H. screw. A hole is drilled through the side of the seat and a 1½ by ¼ in. carriage bolt is inserted. Place a ¼-in. wing nut on this bolt. The nut holds the bracket on the bolt.

Carefully sandpaper the entire outside of the hull. Use coarse sandpaper first, and finish with fine. Sand with the grain. If the hull is to be varnished and mahogany planking used, it will hasten matters and make a better job if the mahogany stain is mixed with the wood filler. After the filler dries, sand lightly, dust, and apply a coat of spar varnish thinned with turpentine. When dry, rub lightly with extra fine paper. Then apply three more coats of spar varnish, sanding lightly between coats. Fill the deck seams with white seam filler before applying the final coat of varnish.

The bottom is painted with red or green bottom paint. A 1-in. white water line such as the original has makes a neat contrast.

If preferable, a paint finish may be applied throughout. Here is a suggestion for an unusually "sporty" finish: Paint with red up to the water line. Above the water line finish with jet black marine enamel. Varnish the decks and use red upholstering material.

STARCH COAT PROTECTS INSIDE WALL PAINT

By applying a protective coat of starch over freshly painted inside walls, the home painter and decorator can preserve his work almost indefinitely. At intervals all the dirt that collects on the walls can be washed off with ordinary soap and water, as the starch comes off easily and takes the dirt with it. When the walls are clean, another starch coat can be applied, and the process can be repeated.

This method can be used with paint of any color, as the starch solution is transparent. To prepare the solution, boil a quantity of cornstarch until it becomes thick, then thin it with water until it can be applied with a brush. Be careful not to thin it too much or it will run.—Roger C. Miller.

A Modernized
Doorbell System
and other new electrical devices for the SHIPSHAPE HOME

By *Harold P. Strand*

Bells, transformer, and two convenience outlets can now be set in one receptacle box

IT IS becoming easier and easier for the handy man to do electrical work around the house because of the large variety of new and more convenient fittings and fixtures which can now be obtained from well-stocked hardware stores and dealers in electrical supplies.

Everyone is familiar with the old type of exposed bells and buzzers on the kitchen wall with their straggly wires, the whole usually covered with an accumulation of grease and dirt. They are invariably placed so high on the wall that a stepladder is needed to clean and adjust them. It has been recognized for a long time that this method was unsatisfactory and that even low tension bell wiring should be placed in some form of conduit for protection against rats and mice and mechanical abrasion, but only now has it become easy for anyone to install a house signal system with complete modern protection.

The new type fittings, shown in Fig. 1, are designed to fit in the standard electric light switch or receptacle box. Conduit can be secured to this box to make a good mechanical job, and the bells and buzzers are attached to the box exactly the same as ordinary lighting fittings. In this way they are placed out of sight and harm. The bell transformer, which is usually placed in the cellar, fits in the gang box along with a double convenience outlet, both drawing their current from one pair of feed wires from the fuse panel. A combination plate of the ordinary type covers the receptacle box and gives the finishing touch to the installation, bringing it in harmony with the rest of the wiring.

A new outlet (Fig. 2), which is designed to facilitate hanging electric wall clocks, consists of a special type countersunk receptacle carrying the attachment plug out of the way in the back; and the plate has a hanger hook attached to it. This provides mechanical support for the clock and an electrical connection for the motor, the whole being concealed behind the clock. This outlet will fit in the ordinary switch box or oblong outlet box.

When it becomes necessary to install a flush receptacle outdoors as on the porch or in some other exposed place, a special plate (Fig. 3) may be obtained which

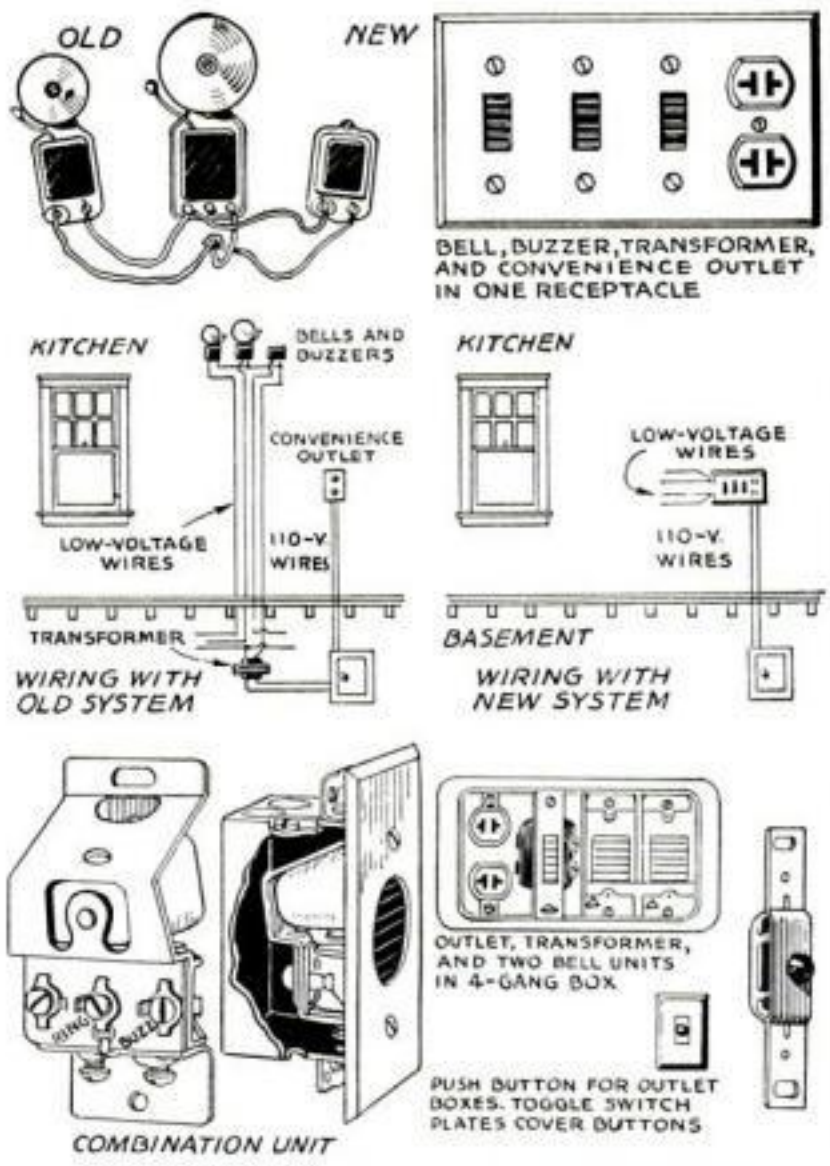


Fig. 1. The contrast between the old and new methods of installing bells is given in the upper half of this drawing; the lower part shows the units and also a new type of button

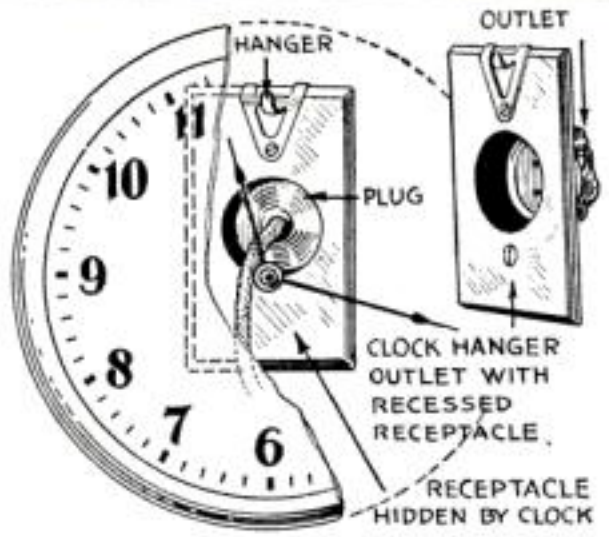


Fig. 2. This outlet allows an electric wall clock to be hung without any visible wires

provides a protecting cover against the weather. This cover unscrews to permit the attachment of the plug. When the plug is in the receptacle, another special cover, which slips over the cord, is screwed tightly into the plate. In addition, there is a rubber mat under the plate to complete the waterproofing.

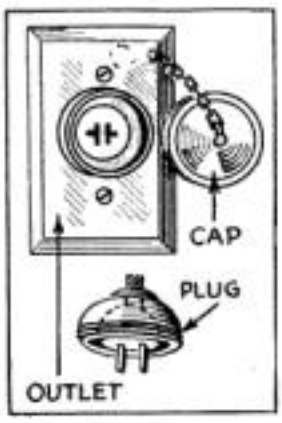


Fig. 3. A waterproof receptacle for outdoor installation

By using a new two-piece socket (Fig. 4), it becomes a very simple matter to make up streamers of lamps for decorative purposes. These sockets can be placed on the wires at any point desired. The action of screwing on the cap presses two points into the copper through the insulation, thus making the contacts. The sockets may be moved along the wires at any time merely by unscrewing the caps.

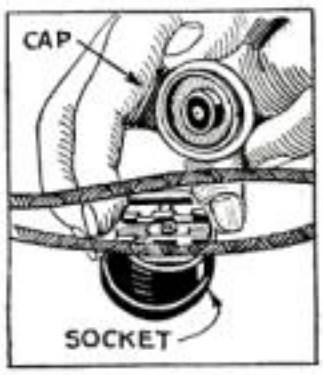


Fig. 4. A two-piece socket for making up lamp streamers easily

Several manufacturers make renewable types of cartridge fuses, and it is an economy to obtain them. When a fuse burns out, remove it from the clips or blades and unscrew the brass ferrules from the ends. This exposes the burned-out lead strip. In the ferrule type of fuse shown in Fig. 5 at *A*, the ends of the strip are secured by the clamping action of the ferrules. The knife blade type of fuses *B*, which are used at amperages in excess of 60 amperes, have a replaceable link that is easily installed.

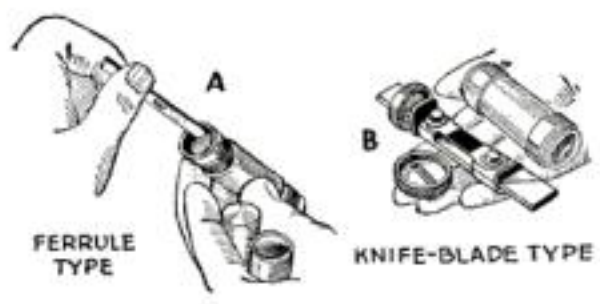


Fig. 5. Two types of cartridge fuses which allow the replacement of a burned-out link

WHAT YOU CAN DO WITH MINIATURE CAMERAS

(Continued from page 92)

mount so that range finding and focusing are synchronized into one motion.

Setting the shutter changes the film so that a double exposure with this camera is an impossibility.

This model sells for about $84 with an F/3.5 lens. As shown in one of the photographs on page 90, the lens is detachable and any one of six other lenses can be used, all of them automatically synchronizing with the range finder. These extra lenses include long focus, extra high-speed, and wide-angle types.

If you expect to turn over your films to a photo finisher for development and printing or enlarging, you will do well to select a miniature camera using standard roll film. Only a few photo finishers are equipped to handle motion picture film. On the other hand, if you are an advanced amateur the camera using motion picture film will appeal to you. It permits the use of the latest types of supersensitive panchromatic film or any other variety of film used in regular motion picture work.

There will be another article in this series next month, and in a later issue Mr. Ryder will take up the problem of making enlargements, which is of particular interest to those who use miniature cameras. He is always glad to answer questions relating to photography and to criticize prints if accompanied by the negatives. Inclose a self-addressed, stamped envelope for his reply and for the return of the prints and negatives.

HAVE YOU AN INVENTION FOR SALE?

(Continued from page 30)

Office, and may be the deciding factor in getting the patent through. This is only natural. There is no better proof of the need for an invention than the fact that thousands of people are willing to pay their hard-earned money for it.

Nor is that all. Once an invention is patented, its ability to make money will serve as a persuasive argument to convince judges, in possible disputes, that the patent was properly granted and the invention is a real one. This has happened time and again. And the curious part is that sometimes an inventor's rivals, by furnishing proof of the popularity of his invention, establish the validity of his patent!

Take, for example, the case of the inventor of an ingenious ash tray. It consists of a receptacle resting on a stand at the base of which is a reservoir that holds a large quantity of ashes and automatically extinguishes live cigar and cigarette stubs.

THIS invention was infringed by a rival manufacturer, who sold the ash trays in huge numbers. When sued for infringement, his defense was that there was no novelty in the device; in other words, that no invention had been made at all. But the judge, in his decision, held that the rival manufacturer himself, by selling the article by the thousands, had involuntarily proved that the first inventor had made a real invention and was entitled to an adequate return on his patent. The court upheld the patent and ordered the infringer to pay damages.

One important factor in profiting from an invention often is overlooked, particularly by men new at the game. The inventor must not be blind to possible uses of his invention other than the one he had in mind at the time he devised it. Many times, inventions perfected for a special purpose have proved commercial failures in that field, but made fortunes when applied to others. Also, the inventor must be willing to change his apparatus or process if it develops that this is the only way to make it practicable or profitable.

Copper today costs six cents a pound instead of sixty, because a young English mining engineer, Arthur E. Cattermole, was willing to have others modify a process he discovered and eventually apply it to purposes for which he had not intended it.

Cattermole's case is one of the most striking on record of an accidental discovery earning millions for the lucky man who made it. He is wealthy today because years ago, when working in a London research laboratory, he could not find any soap to wash his hands!

On that memorable day, Cattermole had been busy with zinc ores. Preparing to wash up, he found all the soap gone; and, grumbling, rinsed his hands in plain water. Through the mud-colored water in the wash-bowl, he saw tiny black balls that had settled on the bottom.

Instead of going home, he examined the globules and found they consisted of almost pure zinc sulphide. In other words, the valuable part of the ore on his hands had separated and drifted to the bottom of the bowl. But how was that possible? Suddenly, he remembered that his hands also had been streaked with machine oil. The grease must have cemented the zinc into the little globules!

In the months that followed, Cattermole made many experiments. Shaking up quantities of various zinc ores in bottles with a small fraction of their weight in oil and a great deal of water, he finally found that, if the oil equaled six percent of the valuable mineral in the ore, he obtained uniform results. He interested a group of capitalists. They hired engineers and metallurgists, and established a research laboratory to devise machinery to work the process on a large scale. Incidentally, this syndicate sank a million dollars in the invention before making a cent.

MEANWHILE, the group had gotten possession of zinc mine properties in the Broken Hills desert section of Australia, and there the process was tried out commercially for the first time. While it worked like a charm, financially it was a flop. Too much oil had to be used to show a profit. One day, the engineer in charge in Australia received a cable describing a modification of the process developed in the syndicate's London laboratory, and ordering him to adopt it at once in the concentration plant. In the new method, only a fraction of the oil was needed, and instead of ore globules sinking to the bottom of the vessel, a black froth floated to the top. This was the famous "froth-flotation" process, later applied to copper, reducing its price by ninety per cent.

Don't have a single-track mind, is my advice to inventors. If your invention works, but does not show a profit, try to make it earn money for you, if possible, by changing it to suit another purpose. This is what an American inventor did only recently. Franklin M. Pierce devised a machine for wrapping automobile tires preparatory to shipping them. The invention was duly patented, but commercially it turned out a failure. Pierce continued tinkering with his machine, and made it into a splendid wrapping device for coils of wire.

ONLY A PILOT CAN LAND

(Continued from page 45)

down in an emergency landing. Grass fields and pastures, for instance, are always a lighter shade of green in daylight than plots of growing corn or vegetables. Plowed ground is black or reddish-brown usually; stubble fields yellow-brown. Tall crops, such as grain or corn, can be distinguished oftentimes by wind ripples running across them. Even in moonlight, differences in light and shade on the ground below may help a pilot in a pinch.

IN THE Blue Ridge Mountains, in North Carolina, I once had to bring a Waco "9" down with a dead engine in a big lumber camp clearing after dark. The moon was shining faintly through the thin clouds of a high overcast sky. In its light, the open space stood out as a dark blotch surrounded by the lighter shades of autumn foliage, and guided me to a safe landing.

Sometimes, in sitting down in a strange field after dusk, you can judge your height above the ground, as you near it, by watching the tree tops against the sky. From their position, you can estimate your nearness to the earth and prevent a bad bounce or pancake landing. I usually come in for a dusk landing with the engine turning over around 700 or 800 revolutions a minute to keep the ship from settling too fast.

Regular night-flying ships always carry parachute flares to light up the country below in an emergency landing. Released at 2,500 feet, they burn for three minutes or more, giving off a 300,000-candlepower light which illuminates an area a mile and a quarter in diameter.

A night landing at a lighted airport is as easy as sitting down in daylight. The floodlights spread a carpet of illumination over the field, showing you just where to level off. A landing head-on to the lights should be avoided. The glare may blind the pilot just before the wheels touch.

I had one experience like that a few years ago in Boston, Mass. A New York broker won a $1,000 bet on a big wrestling match there and decided to celebrate with an airplane ride to Canada. I was called out of bed at eleven o'clock to fly a Fairchild from Roosevelt Field to Boston and pick him up. It was a pitch-dark night in late January with the smell of snow in the air. Taking a mechanic along, I hopped off over the dark hangars and headed across Long Island Sound.

THE mechanic had been putting together a whittled-out model airplane when he was called to the field. He brought his kit along and after we got in the air, he wired a flashlight to a strut and went on with his work. I could see him in the rear-view mirror, down on his hands and knees in the circle of light on the cabin floor. Every few minutes he would hammer away and a cloud of brown dust would puff upward from the floor, drift along the ceiling and come down the back of my neck.

Beyond New Haven, Conn., we plowed through driving snow for fifty miles. When we came out of it, stars were glittering through breaks in the clouds and we could see dimly the white fields spread out far below us. Flying with a tail wind, we reached Boston half an hour ahead of time and the airport was dark. I circled the city for twenty minutes before I made out the snow-covered field, looking like a white napkin with a row of little black blocks along one edge.

I spiraled down, cutting the Whirlwind in and out to signal for the floodlights. Somehow, the watchman couldn't find the key. The field stayed dark. Switching on the wing landing lights, I started down. The mechanic crawled back to the tail so that the ship wouldn't nose over if we hit rough ground in the dark.

The wing lights were making two yellow streaks across the snow when I leveled off. I was heading almost directly into the hangars. Just before the ship touched the ground, the watchman found his key. The million-candlepower floodlights flared on. The bluish glare hit me in the eyes like a blow. Blind as a bat, I pulled back the stick and sat down, riding the brake pedals to stop in the shortest distance possible.

That experience taught me a lesson. Now, whenever I sit down at a darkened airport, I head the ship at an angle to the hangars. Then, if the floodlights flare on, they won't blind me.

Another queer experience I had coming down on a floodlighted field occurred at Cleveland, Ohio. I came in at 2,500 feet, a little after midnight. The air at that altitude was as smooth as silk. But, when the floodlights went on, I saw clouds of dust racing across the field, in the grip of a regular gale. I sat down over the hangars, hitting the wind right on the nose. It slowed me up, stopping the ship with a run of a hundred feet. Mechanics at the field told me the freak ground wind had sprung up just as the lights went on and it stopped as soon as I taxied to the hangars.

FOR an experienced pilot, a high-wind landing is easy. The gale slows down the plane so the wheels make contact with the ground at relatively slow speed. When battling into the teeth of a strong wind, a pilot can sit down with a shorter run and consequently can make an emergency landing in a smaller field than when coming down in a dead calm.

In this way, a forty-mile-an-hour wind once helped me land in a tiny cotton patch on the backbone of a knife-ridge in Georgia. Bad weather and a limping engine forced me down. The little field resembled the peaked roof of a house, the sides sloping down too steeply to land on. Fortunately, the gale was sweeping directly along the ridge. With the propeller headed dead into the wind, I came down, landing with one wheel running along one side of the crest, the other wheel along the other side.

Many times, in forced landings, the only available clear spot is anything but flat. It may run uphill or downhill or be rolling. In an uphill landing, you pull up the nose of the ship at the last moment and climb parallel to the upslope while the plane settles. Such a landing requires more speed than an ordinary one. If you lack sufficient speed when you pull up the nose, the ship squashes down through the air and smacks the hillside. Another reason you need excess speed when landing on an uphill field, into a strong wind, is to overcome the down currents, or "settle-drafts," which are found on the lee side of hills when a wind is blowing.

USUALLY, when a plane is landed on the side of a ridge parallel to the top, it touches at one part of a wide circle with the machine banked so its wings are parallel to the angle of the slope. As soon as a machine begins to slow down in such a landing, the tail always tends to swing downhill. This has to be overcome by keeping the rudder over a little to the downhill side or by putting on the brake slightly on the downhill wheel.

Probably the most thrilling landing I ever made on rolling ground took place in fog on a Delaware mountain top late on March 4, 1929.

Three of us were running back pictures of the Hoover Inauguration to New York newspapers. *(Continued on page 105)*

ONLY A PILOT CAN LAND

(Continued from page 104)

Johnny Wagner had a Wasp-Fairchild; Martin Jensen his famous *Aloha*, the Breese monoplane that carried him to second place in the Dole California-to-Hawaii race the year before; and I was at the controls of a 200-mile-an-hour Conqueror-Falcon, the fastest ship in the race.

A cold drizzle had set in during the day. We roared away from muddy Hoover Field in rain and mist. Jensen was forced down four miles from the start at Anacostia Field. Wagner got almost to Philadelphia before fog closed in and drove him down. After I flashed by Anacostia, I was tearing through fog, flying by instruments. Everything was swirling gray-white mist, streaking past the cockpit at three miles a minute.

I passed Baltimore, Md., without seeing it and was almost to Wilmington, Del., before a momentary lightening of the fog showed me an open stubble-field hilltop below. Ahead, fog was rolling toward me like a solid wall. I decided on a quick emergency landing, and swung back.

TREES surrounded the stubble field. On the downwind side, two oaks stuck up like gateposts and in the mist seemed hardly farther apart than the span of the Falcon's wings. I circled three times, losing the field and finding it again in the mist, before I got into position for the landing. The white, rolling wall had almost reached the far boundary of the field when I closed the throttle and came in with the big Conqueror popping.

The landing speed of the ship was more than a mile a minute. It shot between the two oaks, landed heavily in the stubble, ran up one side of a rolling knoll, down the other side, up a second knoll, and came to a stop on the crest. Three minutes later, the dense fog came down over the field like a lid. Less than a mile away, I heard the sound of autos crawling along a highway. I got a lift to Wilmington, caught a fast train for New York, and was able to deliver the pictures in time for the morning edition.

Another thrilling fog landing in a fast ship, I remember, took place at the Montreal airport, in Canada. New York police received a tip that a wanted murderer was coming in on a liner which would dock at Quebec. In a low-wing Lockheed "Sirius," I flew a man from the District Attorney's office up to get him. It was a race with fog all the way. At times, the sun, shining through the clouds behind us, would glint on the rear of the propeller blades while the nose of the ship seemed boring into a solid wall ahead.

WHEN I came down at Montreal, to show our clearance papers, I was within half a block of the airport before I could make out the runway. But that is one field I know like a book. All one fall, two years ago, I flew in and out in a Fairchild cabin ship, delivering New York papers on a daily route from Albany.

Not long ago, the U. S. Department of Commerce proposed a new type of pilot's license, a sort of Master Transport License which would be required of all flyers who handle mail and passenger planes. One of the main tests would be fog flying. Applicants would have to show ability to handle ships without seeing the ground, and bring them out of tail spins by watching the instruments while flying in a hooded cockpit. Usually, four or five hours of special training are required to teach a pilot the intricacies of this type of flying.

Probably every veteran flyer can close his eyes and see a hundred queer fields and airports where he has come down. I remember one at Laramie, Wyoming, where I had to take off and climb 6,000 feet in thin air to get out through a mountain pass. There was another in western Texas where I took off by moonlight over a prairie-dog town that looked like the top of an immense pepper shaker from the air.

AT SARANAC LAKE, in the Adirondacks, I had to sit down on a combined golf course and flying field, landing in a circle turning uphill. Then there was a treacherous field lying at the bottom of a funnel-shaped valley in the Rockies. I had to come down and go up in a spiral, battling powerful downdrafts all the way.

Along the coast of Newfoundland, two years ago, a giant down-draft did its bit to make a midwinter landing amid ice floes and floating logs the most exciting water descent I ever made. Bernt Balchen, Byrd's pilot at the South Pole, Merian Cooper, noted explorer, and I had flown a big Sikorsky amphibian up from Boston to search floating ice cakes offshore for survivors of the film ship, *Viking*, which exploded near Horse Island, in great White Bay.

We were coming in, our fuel nearly gone, from a five-hour flight out as far as the green water, fifty miles from shore. Beyond, as we swung back, we could see a floating iceberg, big as an island, glistening in the setting sun all colors of the rainbow. On our way in, five or ten miles offshore, we passed a dozen ice cakes black with seals. The animals would wait until we were roaring directly overhead. Then they would flop helter-skelter across the ice and disappear from our sight.

It was about five o'clock and the wind was rising when we soared over our base at the Bay of Islands. Drifting ice had come in with the tide and the black water of the bay was studded with grinding "ice-pans" that made a landing on the open water impossible. I swung the ship toward a sheltered cove where a river from Deer Lake empties into the bay, pouring out through an ice-covered gorge more than 2,000 feet deep.

BALCHEN was standing up on his seat, looking for floating logs, when we slid below the rim of these icy walls. The wind, sweeping in off the Gulf of St. Lawrence, was whistling at right angles across the canyon. Inside, the air was boiling. The plane rocked and plunged. Then it hit the biggest downdraft I have ever known. The bottom dropped out of the air. We plunged 200 feet, more than sixteen stories, while the big motors howled at full throttle struggling to pull the ship free from the grip of the descending currents.

When we finally broke away, the descent of the ship stopped as though we had landed on a concrete pavement. Below us, where the open river ran along the bottom of the gloomy chasm, the rocky walls were barely 300 feet apart. Bringing down the seventy-two-foot-span ship in the jumpy air was worse than walking a tightrope on a gusty day. We all heaved a sigh of relief when the amphibian struck the water and plowed to a stop.

The infinite variety of landing conditions is one thing that makes flying so fascinating. Every time you sit down, you have to conquer a new set of circumstances. Every strange airport is a brand-new puzzle. Every landing is a test of skill.

No matter how long a pilot has flown, he can always learn new tricks of the trade, increasing his mastery of the unexpected in bringing a ship to earth. And pilots who differ on many questions all agree: It's the landing that counts!

PRISONS PROOF AGAINST OUTBREAK

(Continued from page 17)

scientific tests. Instead of placing the steel rods outside the glass of the window, as was formerly done, they are now being put *inside*. Experiments showed that in nipping cold weather a bar becomes brittle and is more easily broken. By placing the steel grilles inside the building, they are kept warm and tough. The first to adopt this feature is the new Reading prison in Pennsylvania.

SOME of the latest bars being made for jails and prisons are reported to be absolutely proof against files and saws and are said to withstand even an electric drill. Three fourths of an inch thick, they have a core of low carbon open-hearth steel completely encircled by tool-proof inserts of high carbon chrome steel. These are covered with an outer layer of open-hearth steel and the whole is welded together by a special process. Tests have proved that saws can enter no farther into these bars than an eighth of an inch, no matter how long the convict wields the cutting tool, and electric drills cannot get past the barricade of tool-proof inserts around the core of the rod.

Still another innovation in bar construction has been incorporated in New York's new penitentiary at Attica. Even if a convict sawed through one of the bars used there, an interlocking feature prevents it from slipping out of place. The steel rods are six-sided. They pass through six-sided holes in horizontal strips of steel set about a foot apart. Thin, circular grooves around the bars at these points permit them to be turned slightly after they are in place. Then, they cannot be pulled up or down until they are turned back to the position in which they entered the holes. This is made impossible by other horizontal strips that have holes fitting the bars exactly *in their locked position*. This feature makes it impossible to saw a bar off at the top and bottom and remove it. It has to be cut above and below each crosspiece and removed in short sections.

ON A spring day, last year, three gangsters rode up to the Rhode Island State Prison in a fast touring car. Posing as ordinary visitors they asked to see friends. As they stood talking through the heavy wire netting which separated them from the convicts in the visitors' room, they suddenly whipped out hidden revolvers, slugged the guard, killed a trusty, handed guns to the convicts inside the netting, and, dashing to the car outside, made their getaway. For more than an hour, armed convicts, firing right and left, tried to break through the netting to freedom. Unsuccessful, the leader committed suicide; the others surrendered.

Passing weapons or saws to the prisoners in the visitors' room has been made impossible at the new Riker's Island Prison, New York City, by the use of a special booth with steel walls and shatter-proof glass. Inmates and visitors see each other through the glass while their voices are carried through the steel wall by U-shaped tubes passing around the pane. The angle of these passages is so steep that nothing can be passed through them from one side to the other.

Another feature of this prison makes an outside assault by gangsters or a riot within the walls comparatively easy to handle. At the entrance, Deputy Commissioner of Correction Joseph Fishman told me, a fortress-like control room commands four strategic passages. One leads outside, two connect with the receiving rooms and temporary quarters, and the fourth comes from the prison proper.

Four picked guards occupy the gas-proof steel-walled tower. They can see on all sides through panes of bullet-proof glass and, if necessary, can fire in any direction through loopholes equipped with sliding steel doors that can be opened and closed at will. Two-way loudspeakers, connecting the tower with all corridors, permit the guards to carry on conversations with men in any of the passages without so much as opening a slit in their armored wall.

During a torrent of rain, several years ago, six men "doing time" at Sing Sing drove unhindered out of the prison gates in a motor truck! William Anson, a member of the famous "Canada Blackie" gang of yeggmen, led the spectacular prison break by slipping on the cap and raincoat of a guard and taking a seat beside the convict driver while four other men climbed in at the back of the machine. The gatekeeper, seeing Anson raise his hand as the truck splashed up to his tower, thought he was a guard going out with prisoners and opened the portals, allowing the machine to rumble through the streets of Ossining and into the open country where the prisoners scattered to elude pursuit.

A LOCKING arrangement used on the outer gates at the New Eastern Penitentiary, Graterford, Pa., makes escapes by this route next to impossible. Everyone leaving the prison must pass through two gates. A guard with a key fitting both portals is stationed between. He has to lock the first gate before he can remove the key to unlock the second and he must close a bullet-proof door between himself and the prisoner before he opens the second gate.

The lock on this portal is also controlled electrically from an armored tower. If the guard here suspects anything is wrong, he keeps the outer gate closed until he has made an investigation. This prevents convicts from seizing guards as hostages and forcing them to open the gates. In an attempted prison break, the man in the control tower can flood the space between the two gates with gas to overcome unruly convicts.

As many riots start in the dining room, new prisons have special equipment for the rapid circulation of tear gas to conquer the convicts before they can run amuck. Special high concentration tear gas candles for quelling prison uprisings have recently been developed by the Chemical Warfare Division of the United States Army.

It is not by new devices and equipment alone that prison safety and security are being sought. Radical changes in architecture are being worked out. Many-storied "Skyscraper Jails," ingenious "Telephone Pole Prisons," and circular "Beehive Penitentiaries" have already made their appearance in steel and stone.

FOR many years, Dr. Hastings H. Hart, President of the American Prison Association, has advocated a skyscraper design for jails with police and court rooms occupying the lower three floors, cells for prisoners in the higher stories, and the roof given over to a recreation court for inmates. In discussing this plan, which is being tried in St. Louis, Mo., Memphis, Tenn., and Los Angeles, Calif., Dr. Hart points out that such an arrangement would eliminate escapes like that made from the Tombs, a few years ago, by Vincent Gaffney, gangster.

In broad daylight, this young gunman, awaiting transfer to Sing Sing for manslaughter, made his getaway. Using his belt buckle for a screw driver, he loosened the grating at *(Continued on page 108)*

DON'T WRECK YOUR CAR WHEN REPAIRING IT

(Continued from page 66)

like all the teeth are nearly worn off the ring gear often means only that the gear is loose. A clicking noise that keeps time with the engine probably means that one of the teeth on the pinion is damaged. If it keeps time with the revolutions of the rear wheel, the sound means a tooth or two on the ring gear partly broken away."

"I never noticed any particular noises," Farrel observed, "so I guess I won't touch the rear end at all."

"Logically, the next things to think about would be the transmission and clutch, but unless the transmission sounds mighty noisy in gear or the clutch slips when you step on the throttle, you can forget them, and that brings us to the motor.

"Lots of repair work done on auto motors is just so much time and money wasted. On the other hand there's plenty of motors heading straight for the scrap pile because their owners won't spend a cent on them.

"TAKE bearings, for example. There's no sense wasting time or money refitting bearings on an old car unless they are so loose they make a noise you can hear plainly. On the other hand, you're heading for trouble if you let a clanking connecting rod go because the pounding will make the trouble steadily worse till something breaks.

"Piston slap is one kind of looseness you can let go till it gets quite bad before there's any danger of trouble, but bum rings mean poor compression, wasted gasoline, and continual trouble with fouled spark plugs. Remember that fitting new rings doesn't always cure the trouble, because the cylinders may be worn out of round. In that case the new rings may be worse than the old ones.

"It used to be that carbon in the cylinder head and coated on the tops of pistons made a motor knock so it drove you crazy. Now, with ethyl gas, the motor won't knock with any ordinary carbon deposit, so if the valves seat well enough to make the compression seem fairly even and strong when you crank the motor by hand, and you don't notice any knock with the leaded gas, or any excessive consumption of oil, let the motor alone."

"This motor isn't quite as good as that," Farrel smiled. "It uses a lot of oil, much more than it did when it was new. Besides, she's begun to miss a bit when going slow."

"IN THAT case," Gus advised, "you'd better put a carbon scraping and grinding job on the list and don't forget to scrape and polish the exhaust valve stems. If you think you can handle it, drop the oil pan while you have the head off, unbolt the connecting rod caps, push the pistons out through the tops of the cylinders, and put 'em back again with a new set of rings. Be sure to put the connecting rod caps on just as you found them. Don't get them mixed up or there will be trouble. Pistons should go back in the cylinders they came out of, too."

"I'll be down to get a new set of rings when I get that far along," said Farrel.

"Now as for the ignition and cooling systems and the carburetor," Gus went on as Farrel raised his pencil questioningly, "if they're working right, let them alone. Of course, flushing the radiator and cylinder jacket may improve the cooling, and a new set of ignition cables and spark plugs will pep up the motor; but if it doesn't boil on the kind of driving you do and you're satisfied with the way it runs, why bother?"

"I won't," Farrel chuckled, as Gus and Joe climbed into their car. "I want a new car if I can ever raise the jack, and in the meantime I just want to get by with this old bus. Thanks a lot, Gus, for the advice."

PRISONS PROOF AGAINST OUTBREAK

(Continued from page 106)

the kitchen window on the top floor of the Tombs. Hanging from the sill, he dropped twenty-five feet to the roof of the women's prison, raced across it, plunged another twenty feet to the top of the visitors' rooms, leaped twelve feet more to a low shed, scaled the prison wall, and dropped a final twenty feet to the pavement outside. An auto, with its motor purring, stood at the curb manned by a crack underworld chauffeur. Before the first alarm was sounded, the gangster had been whirled away and the machine was lost in traffic. Skyscraper jails, with a straight drop of many stories below every window, would keep the most desperate criminal from attempting such a break.

Recently completed at Chicago, Ill., the largest jail in America represents another new type of penal architecture. This $7,500,000 structure is laid out in the shape of a huge telephone pole, the cell blocks extending out from the main "backbone" of the building like the crosspieces on such a support. Additional cell blocks can be added, like sectional bookcases, when it becomes necessary to increase the capacity of the building.

TO PREVENT escapes and riots, prisoners are transferred from one part of the jail to another through underground tunnels. Separate corridors are also provided for prisoners and guards to prevent convicts from overpowering keepers in an uprising. The doors of the cells are locked, not with keys, but by means of wheels and levers in a distant, armored tower. The guard in this control room can open all the doors at once or one at a time.

Besides eliminating the danger of criminals escaping by overcoming guards and robbing them of their keys, the new mechanical locking system permits the cells to be opened instantaneously in an emergency, such as a fire. Most of the fatalities in the Columbus, Ohio, disaster resulted from the long delay in opening cell doors by means of keys. Riker's Island Prison has also installed the mechanical locking system.

Another innovation in prison architecture is shown in the design of the Reading prison, in Pennsylvania. The buildings themselves form an interior stockade. Hardened criminals are housed in the center cells. To escape they would have to scale both the high stockade of buildings and the wall inclosed around the penitentiary.

THE most unusual experiment of all is probably the immense circular cell house of the Illinois State Prison, near Joliet. Like a gigantic beehive, it has the compartments for prisoners ranged around the circumference of the walls, with a central guard tower permitting a keeper, looking through bullet-proof glass, to see into every cell.

The idea for such a building goes back 150 years to the English philosopher, Jeremy Bentham. This prodigy, who was studying Latin at three, playing the violin and speaking French at four, entering Oxford at thirteen, and who was the first to suggest a Suez and a Panama canal, spent twenty-five years of his life trying to persuade Parliament to build such a circular penal institution. He called the design a "Panopticon," meaning "seeing all." Nothing came of his efforts. Now the model prison at Joliet is testing Bentham's idea in its revolutionary "beehive cell house." Eventually, this institution will be composed of eleven "panopticons" joined together in one huge unit within an encircling wall.

A generation ago, "Soapbox" Hardy, notorious bank robber, was filling the newspapers with his dramatic escapes from New York prisons. He sawed his way out of the Tombs, was captured, and then sent to Dannemora, a formidable prison that had seen only two successful escapes in forty-five years. There, in six months, he escaped not once but twice!

The latest prison walls are made of smooth, reënforced concrete instead of stone, and the Attica barrier has an insloping projection at the top to prevent throwing ropes and grappling hooks up from the inside.

The foundation of the massive Attica barrier extends deep into the ground, with huge cement "feet" reaching out at right angles to the wall several yards below the surface in order to foil attempts to tunnel out.

IN THIS institution there was an aged lifer who apparently had become reconciled to his surroundings. So meek was this old hermit of the walled city that officials never dreamed he would lead a daring prison break. Yet, for years, he had carried secreted between layers of the leather in the soles of his shoes, a key to freedom. It was a plan of the prison grounds which he had discovered while sorting rubbish from ancient files in the warden's office. Unable to make head or tail of it, he took a plumber, who had been sentenced for burglary, into his confidence. This convict saw by the blueprint that a large exhaust pipe of the ventilating system, carrying air outside the walls, ran directly under a small storage shed which both men visited frequently.

Stealthily, they began their excavating, burrowing downward by scooping out a handful of dirt at a time and distributing it about the prison grounds. Tense weeks followed as the hole grew deeper. Any moment, they might be detected. Finally, after nearly two months of surreptitious digging, they reached the pipe, broke through, crawled 200 feet to the mouth and found it blocked by a heavy steel grille they could not budge!

Another convict, who had been an expert cracksman, was taken into the secret. Carrying a lighted candle and a bit of soft wax, he crawled to the grille and made an impression of the keyhole in the lock. Then, out of a sliver of metal from the plumber's shop, he fashioned a crude key. Two weeks later, the three men crept silently along the length of the pipe, opened the rusty grating and wriggled through long grass to the shelter of a wood. It was not until a check-up was made that evening that they were missed. When the great brass-throated siren screamed the news of their escape, they were miles away.

AT THE new Norfolk, Mass., prison, I was told, a maze of electrical conduits were embedded in the concrete walls surrounding the buildings. This feature will connect the guard towers with special telephones and will permit automatic alarm wires to be installed around the top of the inclosure.

Another automatic signal system which may be applied to guarding convicts was demonstrated a few weeks ago before prison authorities. It is a special photoelectric cell apparatus. To pass a forbidden spot, the prisoner has to walk through an invisible beam of ultra-violet light trained upon the cell. The instant his body cuts off the rays, the light-sensitive metals lining the photo-electric cell are affected and the alarm sounds.

Today, there are nearly a million inmates in American jails and prisons. Penal authorities have turned to science in a supreme effort to keep them from breaking loose and repeating the reign of terror which gripped this country a few years ago.

TURN MOTOR BIKES INTO MOUNTAIN GOATS

(Continued from page 28)

cycle has suffered a crumpled fender, a bent handlebar, and perhaps a distorted frame. Also, the carburetor is full of sand and clay. He will have to spend a few days mending the damage inflicted by the hill. Oh, well. It's good sport. Anyway, he brought along two other hill-climbing machines so that he can take part in later events.

Every contestant in an "official" hill-climbing event must be a member of the American Motorcycle Association. No women are permitted to ride: they come to the meet merely as spectators. The program of the day includes five events. First, the expert riders on their little single-cylinder motorcycles of twenty-one-cubic-inch piston displacement tackle the hill and chop it up a bit for the others. Next come the amateur Class B riders on their forty-five-cubic-inch twin-cylinder machines. The third event is a Class A expert contest on the larger machines. Fourth is a forty-five-cubic-inch Class A professional climb; and finally, an event for amateurs on eighty-cubic-inch hill-climbers.

Admission charges to spectators pay for prizes and offset other expenses involved in staging a hill-climbing show, and sometimes leave a profit for the treasury of the club sponsoring the entertainment. In fact, it was to raise some pin money for the club treasuries that hill-climbs first were held.

HOWEVER, the real expense—the original cost and maintenance of individual motorcycles—is borne by the enthusiasts themselves. It takes no little amount of money to go up a hill as they do. A machine designed only for running up almost vertical hillsides costs, when new, in the neighborhood of $450. The demand is not great, so that factories produce them in small lots and at odd moments. That accounts partly for the greater cost as compared with a standard motorcycle. In addition, the special engine and other fittings run the price up. The typical hill-climbing enthusiast does not complain about buying one or more of these machines if he can go over the top a reasonable number of times, and perhaps win a prize now and then.

"But it looks dangerous," you say; "this trying to ride up the side of a miniature mountain that would baffle a goat."

"Dangerous!" the rider snorts scornfully. "Why it's lots safer than most sports. I've been in a dozen climbs, and never got hurt but once; and that was when the hookman snared my leg instead of the motorcycle."

BUTTERFLY'S SENSE OF TASTE FOUND IN LEGS

A BUTTERFLY'S leg is 1,600 times as effective as a man's tongue as an organ of taste. That is the conclusion reached following experiments with more than 200 butterflies, representing ten species, made recently at the University of Minnesota. In making the tests, the legs of the insects were dipped in water, then in solutions containing sugar of milk and ordinary sugar. As soon as the butterfly was able to detect any sweetening in the water, its proboscis became uncoiled and extended. Gradually reducing the sugar in the solution, the smallest amount the insects could detect was discovered. Further tests showed that this amount had to be increased 1,600 times before a human tongue could detect it. The common milkweed butterfly was found to have the most highly developed sense of taste of all those tested.

NEW RADIO TUBES SHOW STARTLING CHANGES

(Continued from page 63)

second detector. Some of the new sets will use this tube while others will use the 56 as second detector.

Type 58 is essentially the same as type 57. In addition to the features of 57, the 58 is of the variable mu type and so will be almost universally used in the new sets as a radio-frequency amplifier. It is by all odds the most efficient radio-frequency amplifier tube ever made.

The peculiar arrangement of the elements in both 57 and 58 produces an extremely low internal capacity. In fact, type 58 will perform effectively as a radio-frequency amplifier even at the ultra high frequencies of five-meter transmission. This is of particular interest, as much of the serious experimental work in television transmission is being done on five meters.

As this is being written, heated discussions are going on as to the possibilities of the new power tube type 46. Although this tube looks almost exactly like the types 245 and 247 now in use, electrically it is totally different.

THE characteristics of 46 make possible the use of a revolutionary new type of circuit. Most radio enthusiasts are familiar with the "push-pull" power circuit. A large majority of the sets now on sale have it. Type 46 permits a circuit that looks much the same on paper but instead of being push-pull it is "push-push."

In push-push amplification, each of the two tubes works only half the time. The signal frequency, as it reaches the last or push-push stage, actually is an alternating current. One of the type 46 tubes works on half the cycle and the other on the other half the cycle. In fact the terms "push-pull" and "push-push" suggest exactly what goes on. With 245 or 247 tubes in the last stage, both tubes work all the time. While one is pushing the signal, the other is pulling it from the other side. Now, with 46 tubes, the signal is alternately pushed first by one tube and then the other.

On the face of it, push-push would appear to be less effective than push-pull, but a properly designed tube can be made to give a one-way action far stronger than the combined effect of two-way action. The result is that two 46 tubes operating in push-push circuit will give far more volume without distortion than has ever been obtained from any standard type of broadcast receiver.

THE secret of the new power pentode functioning lies in a construction that makes C biasing unnecessary. Only a few milliamperes of current flow through the plate circuit of the type 46 when it is on the non-working half of the tone cycle. On the working half it draws current in proportion to the intensity of the signal frequency.

Unlike 247 tubes which draw a steady, heavy load whether or not a signal is being received, the new tubes consume current in proportion to the volume level.

This has two effects. First, there is a definite saving in the power drawn from the line by the power tubes in addition to the saving in heater current already mentioned. Second, the rectifier tube in the set is called on to supply a constantly fluctuating load and it is because of this feature of push-push operation that a new type rectifier tube has become necessary.

The type 82 mercury vapor rectifier has been developed to meet this need. In appearance it resembles the well-known type 280 now used in every set, although the glass globe is smaller. The new tube, however, has a relatively constant and much lower average voltage drop.

JOBLESS MEN WORK MIDGET MINES

(Continued from page 11)

the hopper, which is equipped with a screen to keep out large stones. It is then discharged into the slanting trough, the bottom of which is lined with fine-meshed cloth. This cloth forms the top side of a bellows attached beneath.

As the bellows is pumped, the imprisoned air puffs up the surface of the cloth, throwing the dirt up slightly into the air and gradually impelling it down the chute. The gold particles, by their weight, lodge next the riffles and remain until the "clean-up." Usually the dry washer is improved by the addition of an eccentric, which permits the bellows to be turned with a crank, and as heavy a flywheel as is practical, to make the machine run more smoothly. When enough concentrates have accumulated, they are taken to water and panned.

ALTHOUGH the greenhorn is often content merely to take dirt and gravel from the surface or the bank of a stream bed, the more experienced miner often digs to bedrock, then sinks tunnels until he strikes traces which may lead him to a pocket. In the old Randsburg district, I found many such diggings. At one newly started shaft the operators were at work, one above ground, the other in the shaft. At the surface they had built a wooden platform with a windlass to lift the bucket carrying excavated material to the surface.

"After prospecting this district," said one of the miners, "we decided that our best chance lay along an old buried stream bed, in which several others had been finding fair pay dirt. Sighting between two of the most successful workings, we located what seemed to be the trend of the deposit. Allowing for the slope of the ground, we decided to put down our shaft between the two claims. We marked our location, measured 750 feet each way and 300 feet on each side, to establish boundaries, and erected a stone monument on each corner, as prescribed by law. Then we built this platform and windlass and set to work.

"We have now been digging four days and have made our shaft eight feet long and twenty-five feet deep. As we go down, we make tests to see if we are striking pay dirt. Using this square tin box, which contains one-twentieth of a cubic yard, and is punched in the side with holes, each of which marks one tenth of the volume, we measure out a certain amount of dirt, run it through the dry washer, and pan the concentrates until we have obtained all the gold in this volume of dirt. In this way we can estimate the richness of the deposit.

"WE PLAN to sink to bedrock, then to strike out upstream. We believe that the richest deposit will be along the bedrock, the site of the ancient stream bed, where the river made a bend.

"Professional miners? Not us. I am a building contractor. My partner until recently was purchasing agent for a large manufacturing company. We learned the business from books and from talking with other miners."

Perhaps the most unusual project of its kind is the Engineers' Lease, near Cripple Creek, Colo., where a number of unemployed graduates of the Colorado School of Mines are working small mines, furnishing engineering skill and labor in exchange for a grub stake plus a share in the return. Alumni of the school organized a company, financed it, and took leases on several properties on the "split-check" basis. The mining company owning the leases furnishes the supplies and equipment, and Engineers' Lease operates the mines, the returns being divided equally.

Each of the graduates works for himself on a grubstake basis, receiving $1.25 a day for board and expenses. After the ore is mined, shipped to Colorado Springs, and the gold extracted, the profits of Engineers' Lease are divided three ways: two-fifths to the men doing the work, in proportion to the number of shifts they work; two-fifths to the men furnishing the money, in proportion to the number of shares they purchased; and one-fifth to the Mines Alumni Association, for originating, financing, and managing the plan.

A somewhat similar grubstake proposition is offered by J. C. Duke, owner of a gravel claim near Saugus, Calif. He offers to let any man who has enough money to see him through the first week or so, select a piece of placer ground for himself and work it, sharing the profits with the owner.

Although the greater part of the small-scale mining is placer in nature, some of the more experienced and better informed amateurs are trying their hand at hard-rock mining. Since in this kind of mining the gold occurs in hard formations like quartz, it requires more knowledge to locate it and more work to extract it, with pick, shovel, and dynamite. This type of prospecting is generally done only by those who have enough knowledge of minerals or of geology to judge what formations are likely to lead to gold-bearing veins.

Some of these formations do not contain the gold in a form that can be detected by its characteristic yellow color. The prospector must break up the ore by pounding it to powder in an iron mortar. Any free gold can then be washed out by panning; or it can be picked up by amalgamation with mercury. The pasty amalgam is heated upon charcoal under the flame of a blowpipe, distilling off the mercury and leaving the pure gold. This residue, mixed with borax, is then heated by the blowpipe upon charcoal until a yellow button is formed.

THE amateur prospector who goes out for this kind of ore needs enough apparatus to perform simple tests for gold. A typical inexpensive outfit comprises a spirit lamp, candle, blowpipe, magnet, bottle of hydrochloric acid, a quart glass jar, three test tubes with corks, two feet of glass tubing, copper wire, two square inches of tin plate, forceps, and test papers.

When a promising vein or ledge is located, the miner is anxious to take samples to the assayer. These samples are taken clear across the vein, at intervals of five to ten feet, so as to give a representative value for the whole mine. The rock is laid upon a clean canvas and broken up until no piece is more than an inch in diameter. It is thoroughly mixed and piled up in a heap, which is then evenly divided into quarters. Opposite quarters are removed and thrown away or kept for another sample. This process is repeated until the desired quantity, usually three to five pounds, is left for the sample bag. Care is taken to keep all the dust and dirt as well as the coarser ore.

In staking out his claim, the prospector usually raises a location post bearing the notice required by law. This document, rolled up and placed in a tin can at the base of the monument to protect it from the elements, contains the following information: the name of the claim, its locator, date of location, number of linear feet claimed along the course or strike of the vein each way from the point of discovery, with the width on each side of the center of the vein; and finally, the information as to the location and description of each corner, with the markings thereon.

Comb Earth for Priceless Plants

(Continued from page 35)

can have it green if you like, and eat it raw just like a pear; or with cream and sugar.

Meyer, in his roamings about the Orient, became convinced that there were superior kinds of peaches in some of the hidden corners of China. But one of his most promising finds, the Chinese wild peach, was not growing in an Oriental wilderness, but in the German legation garden at Peking! Although the peach failed to live up to expectations, it was an interesting find.

Meyer learned that the village of Fei in the province of Shantung was famous for a very excellent and large peach. He made up his mind to get some of the peaches for Uncle Sam, but the natives said, "NO," and added various threats by way of emphasis. Fei, it seems, had a peach monopoly, and was determined to keep it. Meyer was just as determined to get some specimens. Finally, after unsuccessful attempts of various kinds, he was offered a whole orchard of peaches by a Chinese farmer. Buying a large orchard in order to get a few trees seemed extravagant, but it was the only way. When the trees from Meyer's Chinese orchard were brought to the United States, they were identified as some other variety, and not the famous Fei peach trees after all. So Uncle Sam still is on the trail of the giant Chinese peach.

THE Chinese or Siberian elm, a tree that will grow in the prairie region of the United States where other shade trees are unknown, is one of Meyer's important contributions to American agriculture. Another tree that he found is the Chinese chestnut. It is expected to become of great economic importance because it is not seriously affected by the blight that has killed so many thousands of American chestnut trees.

Meyer was a lone worker, and early became convinced that the best way to explore a strange land is on foot. In his travels over China he was attacked by robbers, captured, thrown in jail, subjected to almost every other kind of adventure. But to Meyer, such adventures were mere irritating annoyances that interfered with his work.

After his death, some unlabeled seeds from an unknown grass were found in his baggage. These were planted, and the resulting grass grew in long runners with roots sprouting out at every joint. So much did the plant resemble a centipede that it was named "centipede grass." It was found to produce seeds so rarely that the best way of introducing it in a new location is to plant chopped up joints. The grass grows well in southern Florida, and it has been introduced by David Fairchild, for many years head of the Plant Introduction Division, to Gibraltar where, if it grows, it some day may cover that famous rock.

Dr. Fairchild is himself a plant hunter of ability and accomplishments. Outstanding among his searches are the Armour Expeditions, years of adventure in plant capturing conducted by him in conjunction with Allison V. Armour, who is noted for his extensive scientific travels and explorations.

Part of this work is carried out from the *Utowana*, a yacht specially equipped by Armour for the work of plant exploring. It is a floating laboratory, and was used by Fairchild and his associates on the recent trip to the Caribbean islands. Besides cases and other equipment for preserving collected specimens, the yacht carries a supply of plants from the United States which are given in exchange for foreign types.

England, France, Switzerland, Spain, Morocco, Algeria, the Canary Islands, Ceylon, Sumatra, Java, French Guinea, the Liberian Republic—these are some of the places that Dr. Fairchild and his party have visited.

Tables of America may in a few years have added to their delicacies a tropical fruit of great promise, the mangosteen, Dr. Fairchild believes. He considers this the queen of tropical fruits. He first encountered the mangosteen in Java in 1895, and since then has tried, with considerable difficulty, to introduce it into Florida and tropical and semi-tropical possessions of the United States.

In recent years mangosteen orchards have been established with considerable difficulty in Honduras and in Panama, so that before many years Dr. Fairchild's dream of a mangosteen-eating America may be realized.

The never-ending search for wheat that will resist disease or grow under severe weather conditions, or produce better bread, or offer some other advantage, occupies much of the time of the plant hunters.

Millions of acres in the great wheat fields of the United States are planted with grain that, a little more than thirty years ago, was

a Russian immigrant. Mark Carleton, a plant hunter, went to dreary regions beyond the Ural mountains, looking for wheat that would make happier the lives of farmers in Kansas and Minnesota and other wheat states. He brought back seed of the now famous Kharkof, a red wheat that nods its bearded heads over more than 2,000,000 acres of the Middle West; and of the Spring Kubanka that is grown even more extensively.

At about the same time that Kharkof wheat was paying its first visit to America, Sample No. 6015, from the Crimea in Russia, came across the Atlantic. For a long time it lost itself among the millions of other seeds that pass through the Plant Introduction Division. Finally, someone sent a few grains to the Kansas Agricultural Experiment Station. The wheat experts there went to work on it, and produced a promising variety that they named "Kanred." Today, this high-yielding, rust-resisting red winter wheat covers more than 4,000,000 acres each year.

Because of its importance and the demand for varieties to expand its culture in other varying climatic sections, W. J. Morse, soy bean specialist of the Department of Agriculture, was sent to the Orient with P. H. Dorsett for a thorough search for new soy bean varieties. They returned in the spring of 1931 after almost three years exploration in Japan, China, Manchuria and Korea. In addition to varieties and cultural methods, they gave special attention to by-products of which there are countless numbers, as, in the Orient, the soy bean is primarily used for human food.

Of more than 600 alfalfas that have entered this country, several have become important. The Hairy Peruvian alfalfa, that first made its appearance as foreign plant sample No. 3075, in 1899, has become popular in parts of Arizona, in the interior valleys of California, and in New Mexico and southern Texas. Among the types included in the very important variegated group are valuable hardy introductions such as Cassock and Ladak.

Sudan grass hails from Africa, and first made its appearance in 1909. Almost overnight it became famous because it resists drought and will therefore grow successfully in the dry areas of the Southwest. Its yearly value is in the neighborhood of $10,000,000.

It is difficult to say which of the plant immigrants has enjoyed the greatest success. The amount grown or the annual value cannot be used as a final gage. But no picture of plant hunting should be painted without placing cotton in a prominent place. From Egypt and Mexico have come some of the most successful cottons. Acala, found in the southern part of Mexico nearly 25 years ago, grows to the tune of $50,000,000 in the Imperial Valley of California, and in adjacent districts. Egyptian cottons have contributed many millions of dollars to the wealth of Arizona during the past decade.

Commercially, the avocado was unknown in the United States until a few years ago. Its firm flesh and distinctive flavor is winning new admirers constantly. It came to the United States as a modest fruit from tropical and semi-tropical regions of the American continent.

Four plant explorers went during the past year to Mexico to look for wild potatoes. Two are going to South America this year. If you were to see one of the most promising potato varieties, you would wonder what earthly benefit it could give to American gardens. Potatoes hardly larger than peas!

But it is not the size that is important; it is the resistance to potato diseases and to freezing. By crossing these midget potatoes with those of larger size, growers hope to produce a plant that retains the best characteristics of all its parents, one that produces good-sized tubers in spite of the frost and disease that it may encounter.

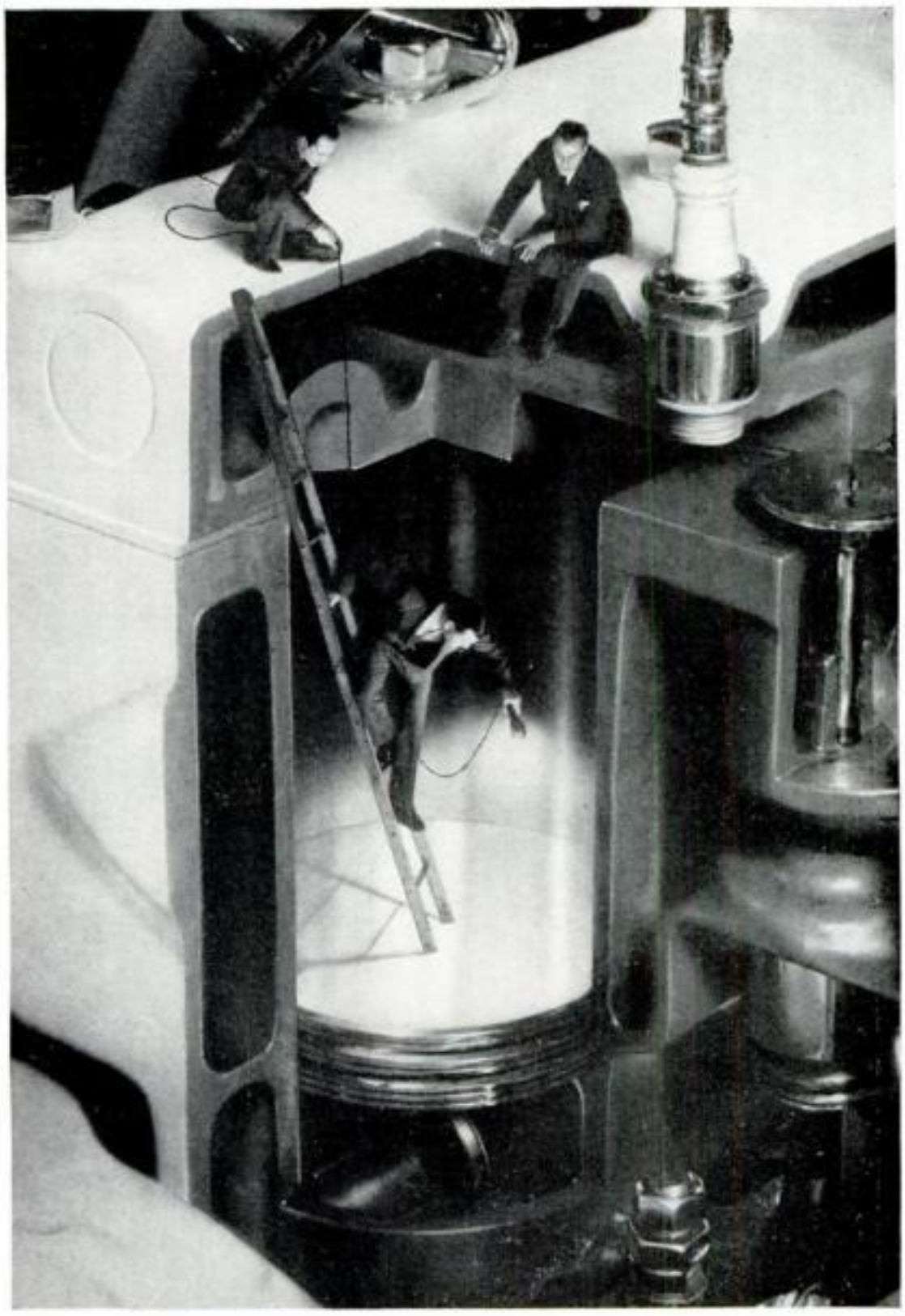
MUCH of the work of the Division of Foreign Plant Introduction is done in connection with requests from the research workers of federal and state stations, from botanic gardens, arbereta and other institutions whose various projects require plant material from foreign sources.

Then, hand in hand with the search for entirely new wonders of the plant world, goes the never ceasing work of increasing the usefulness of the immigrants that already have been naturalized. Mostly this is in the direction of greater resistance to disease and to other natural enemies such as cold or drought. Fortunately, now and then an explorer stumbles across a plant that resists some particular insect or mold, or freezing or dry weather. The explorer captures that plant, and later turns it over to his friend the breeding expert, who tries to impart the plant's unusual ability to domesticated plants that are weak in that particular respect.

The next time you visit a botanical garden or a commercial plant nursery, you will find it interesting to inquire about the ancestry of the numerous plants that you meet. You will be surprised to find that your favorite rose or lily or fruit originally lived in some distant land, and for that reason it may be even more of a favorite than before.

Climb down inside your Engine

SEE *the difference Ethyl makes*



THE true story of gasoline has always been hidden behind the steel walls of your engine. Squeezed by flying pistons, trapped by clicking valves, caught in terrific heat—there's where gasoline shows its true colors.

But what happens is no longer a secret. Detroit engineers put a quartz window in the top of an engine and took high speed photographs of the actual combustion of motor fuels. Now you can SEE the difference Ethyl makes.

Look at the pictures below. On the left, ordinary gasoline is wasting power in a violent explosion. Its furious energy hammers against the cylinder walls, causing harmful knock, overheating, and engine wear-and-tear.

On the right, you see how Ethyl Gasoline delivers power smoothly, driving your car with an even stride—you see why it delivers *more* power and leaves *less* waste heat.

Now *feel* the difference Ethyl makes. Stop at an Ethyl pump, fill up with the new, higher standard quality Ethyl Gasoline. Notice instead of irritable power that you're almost afraid to use, Ethyl will give you the thrill of flowing, steam-pressure smoothness—plenty of power when you need it and freedom from harmful knock. Ethyl Gasoline Corporation, New York.

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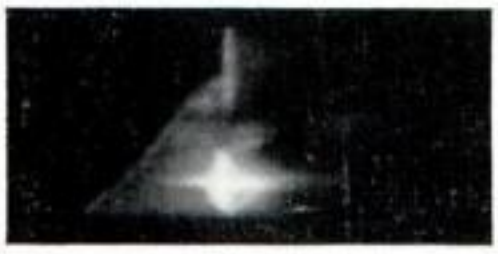

The wasteful explosion of ordinary gasoline. The vertical line of light shows the almost instantaneous flash that signals its sudden death! See how short its life is in contrast to the picture at the right.

The smooth combustion of Ethyl Gasoline—whether your motor is idling or under strain. The Ethyl fluid in it controls combustion, makes the gasoline deliver power evenly throughout a relatively long life.

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NEVER PARCHED OR TOASTED

Switch to Camels

then leave them—if you can

IF YOU want to know the difference between a truly fresh cigarette and one that is parched or toasted, light a Camel.

As you draw in that cool, fragrant smoke notice how smooth and friendly it is to your throat. Not a hint of sting or bite. Not a trace of burn.

That is because Camels are blended from choice Turkish and mild, sun-ripened Domestic tobaccos, and are made with just the right amount of natural moisture and kept that way until delivered to the smoker by the Camel Humidor Pack.

Camels are never parched or toasted.

That's why Camels bring you so much unalloyed enjoyment. That's why they are so much milder; why they leave no cigaretty after-taste.

If you haven't tried Camels lately, get a package today and see for yourself what you are missing.

Switch over to Camels. Then leave them —if you can.

R. J. REYNOLDS TOBACCO COMPANY, *Winston-Salem, N. C.*

CAMELS

***Made* FRESH—*Kept* FRESH**

● *Don't remove the Camel Humidor Pack—it is protection against perfume and powder odors, dust and germs. Buy Camels by the carton for home or office. The Humidor Pack keeps Camels fresh*